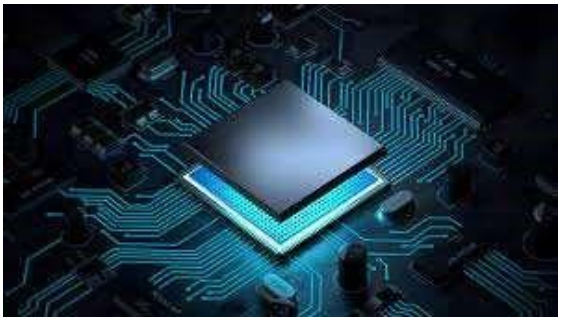

Water Heater Project

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Table of Contents

Introduction

This Project aims to control the temperature of a water using a heater and cooler using on and off control. This will be done electrically using microcontroller and some other components like

1. 24C08 EEPROM, or use the internal.
2. Temp sensor (LM35, or equivalent DS18B20).
3. Cooling Element (Peltier).
4. Heating Element (3d ceramic heater).
5. 7-segments.
6. LEDs.
7. Push Buttons.
8. Solid State Relays.
9. Cooling fins & fans.

Specifications

Temperature Setting

1. The “Up” or “Down” buttons are used to change the required water temperature (set temperature).
2. The first “Up” or “Down” button press, entersthe temperature setting mode.
3. After entering temperature setting mode, a single “Up” button press increase the set temperature by 5 degrees.
4. After entering temperature setting mode, a single “Down” button press decrease the set temperature by 5 degrees.
5. The minimum possible set temperature is 35 degrees.
6. The maximum possible set temperature is 75 degrees.
7. The “External E2PROM” should save the set temperature once set.
8. If the electric water heater is turned OFF then ON, the stored set temperature should be retrieved from the “External E2PROM”.
9. 9. The initial set temperature is 60 degrees

ON/OFF Behavior

1. If power is connected to the heater, the electric water heater is in OFF state.
2. If the “ON/OFF” button is released and the electric water heater is in OFF state, the electric water heater goes to ON state.
3. If the “ON/OFF” button is released and the electric water heater is in ON state, the electric water heater goes to OFF state.
4. In the OFF state, all display should be turned OFF

Temperature Sensing

The temperature sensor measures the water temperature.

2. The water temperature should increase, if the “Heating Element” is ON.
3. The water temperature should decrease, if the “Cooling Element” is ON.
4. Temperature should be sensed once every 100 ms.
5. The decision to turn ON or OFF either the “Heating Element” or the “Cooling Element” based on the average of the last 10 temperature readings

Heating/Cooling Elements

1. The “Heating Element” should be turned ON, if the current water temperature is less than the set temperature by 5 degrees.

2. The “Cooling Element” should be turned OFF, if the current water temperature is less than the set temperature by 5 degrees.

3. The “Heating Element” should be turned OFF, if the current water temperature is greater than the set temperature by 5 degrees.

4. The “Cooling Element” should be turned ON, if the current water temperature is greater than the set temperature by 5 degrees

Seven Segments

1. Seven segment by default show the current water temperature or the set temperature.
2. By default, the 2 seven segment displays are show the current water temperature.
3. If the electric water heater is in the temperature setting mode, the 2 seven segment displays should blink every 1 second and show the set temperature.
4. In the temperature setting mode, every change in the set temperature should be reflected on the 2 seven segment displays.
5. The 2 seven segment displays should exit the temperature setting mode, if the “UP” and “Down” buttons are not pressed for 5 seconds

Heating Element Led

1. If the “Heating Element” is ON, the “Heating Element Led” should blink every 1 second.
2. If the “Cooling Element” is OB, the “Heating Element Led” should be ON

Design

software

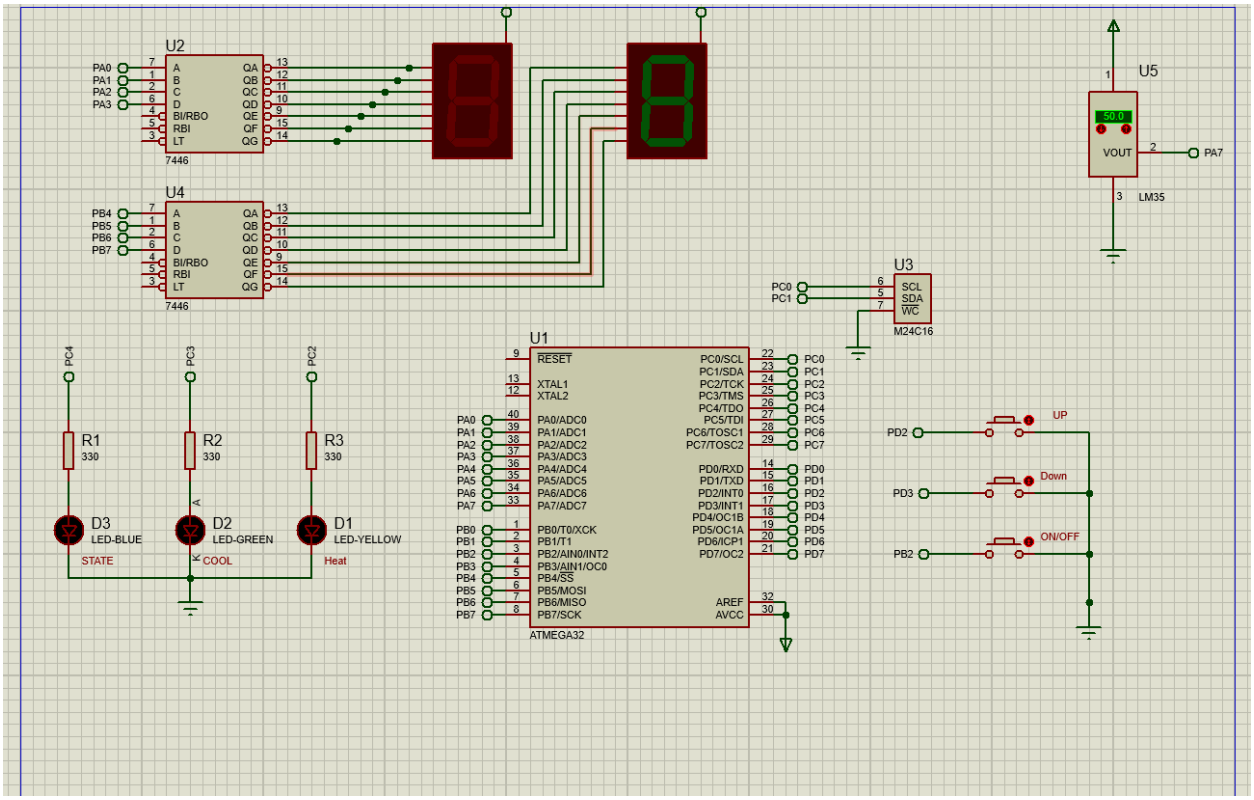
Software design The software is divided into layers MCAL, HAL, Application and Helper

In MCAL there are DIO, ADC, TWI, External interrupt and Timer 0 drivers where each driver is SOLID.

In HAL there are LED, Button, Heater, LM35, seven segment and EEPROM Drivers where each driver is SOLID.

In Application there is a header file and a source file same as each driver In Helper there are the types, bit math, registers and there is main file.

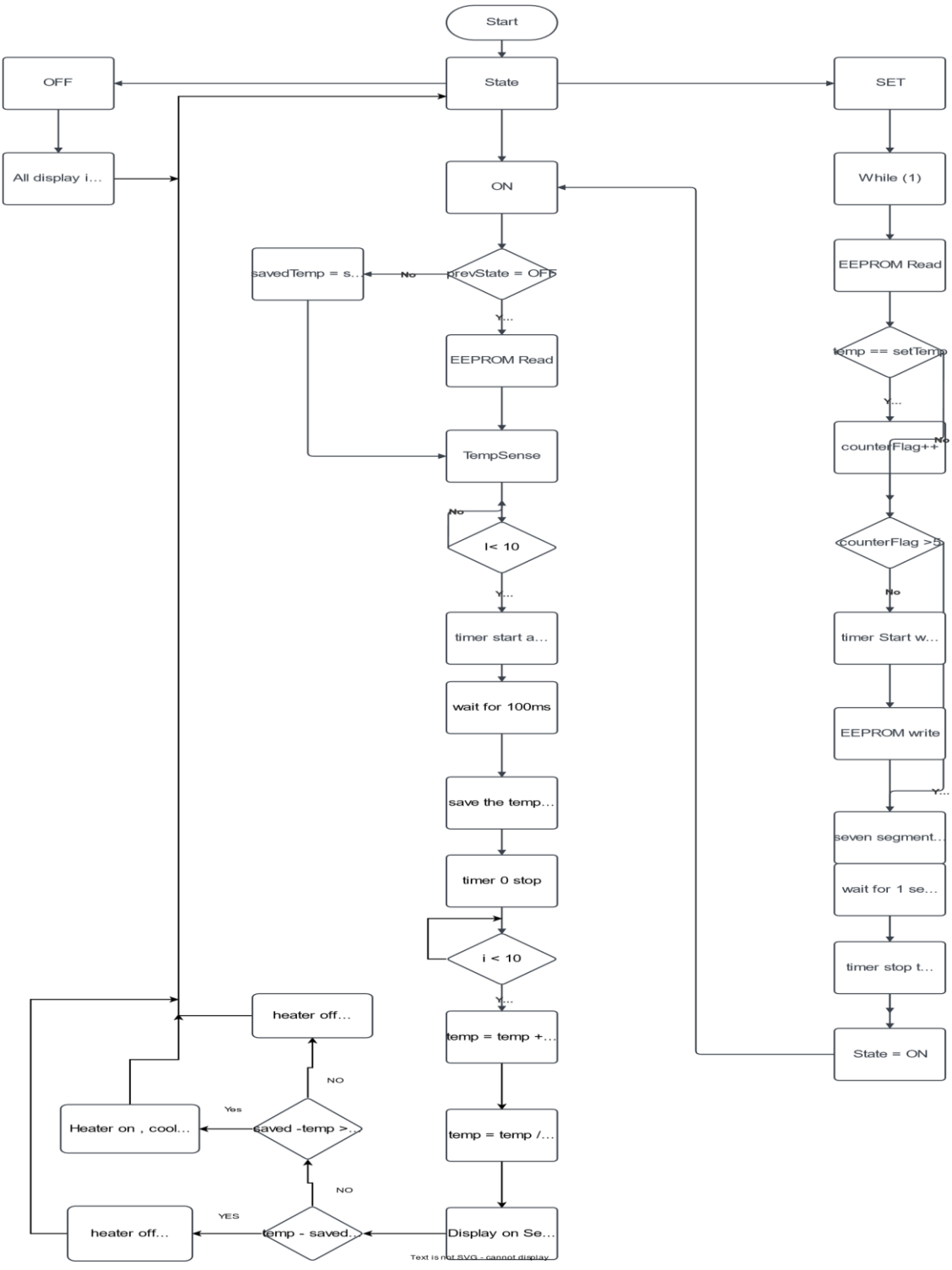
Hardware



GitHub:

[MuhammadNasser12/ElectricalWaterHeater: AMIT Graduation Project (github.com)](https://github.com/MuhammadNasser12/ElectricalWaterHeater)

Flowchart


Start
State
OFF
SET
All display i...
ON
While (1)
savedTemp = s...
No
prevState = OFF
EEPROM Read
Y...
EEPROM Read
temp == setTemp
Y...
counterFlag++
No
TempSense
counterFlag >5
No
I< 10
No
Y...
timer start a...
timer Start w...
wait for 100ms
EEPROM write
save the temp...
Y...
seven segment...
timer 0 stop
wait for 1 se...
i < 10
timer stop t...
Y...
heater off...
temp = temp +...
State = ON
NO
Heater on , cool...
Yes
saved -temp >...
temp = temp /...
NO
heater off...
YES
temp - saved...
Display on Se...
Text is not SVG - cannot display