Faculty of Information Technology

Fully Automated, Boiler water condition monitoring& regulated feed system

IN 1900- Group No.27

Group members:

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1.0 Introduction

Steam boilers are widely used in many industries mainly in order to generate power and energy. Boiler water must be well maintained and fit for purpose in order to mitigate the risk of boiler failure.

Boiler water testing and reliable boiler operations is a key task for industry. Staff members do their best to test water and maintain predictable operations, but however the testing is done manually and very much time-consuming. Also, there is a significant possibility of human error. Making the result being unreliable day by day more difficulties arise due to the testing process being manually.

2.0 Aim and Objectives

❖ **Aim**

To eliminate boiler failure and extending its life by maintaining boiler water within acceptable, pre-determined parameters whilst avoiding human error.

❖ **Objectives**

➢ To get Real time readings of boiler water parameters automatically**.**

➢ To automate releasing required chemicals to water in accurate amounts based on the readings**.**

➢ To eliminate human error

➢ To reduce cost, make the whole process efficient, save time and to reduce risks**.**

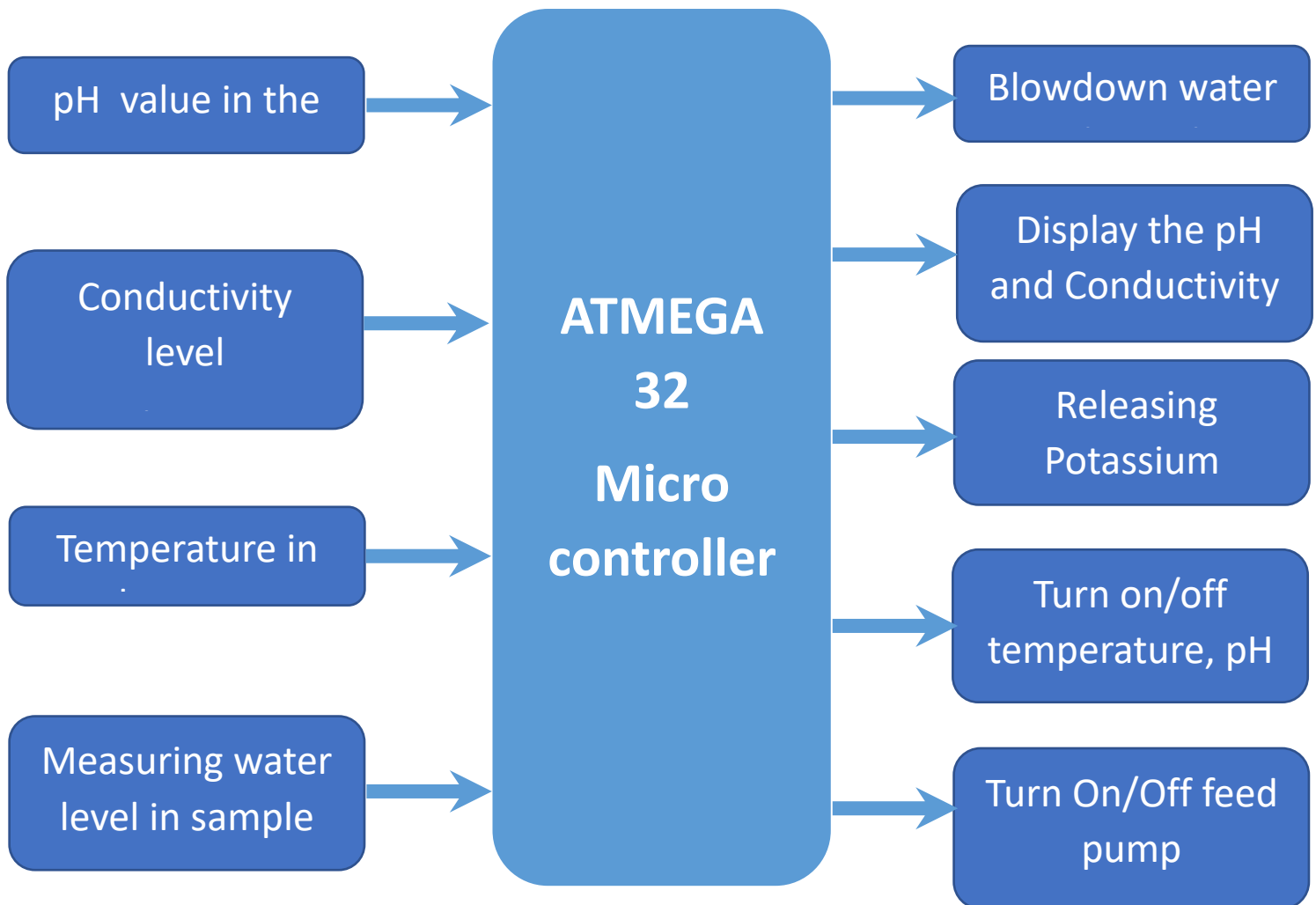# 3.0 ANALYSIS AND DESIGN

3.1 Proposed Solution


```
pH value in the          ┐
                         │
Conductivity level       │      ┌──────────────┐      ┌─ Blowdown water
                         ├─────►│   ATMEGA     │─────►├─ Display the pH and Conductivity
Temperature in           │      │     32       │      ├─ Releasing Potassium
                         │      │    Micro     │      ├─ Turn on/off temperature, pH
Measuring water level    │      │  controller  │      └─ Turn On/Off feed pump
in sample                ┘      └──────────────┘
```
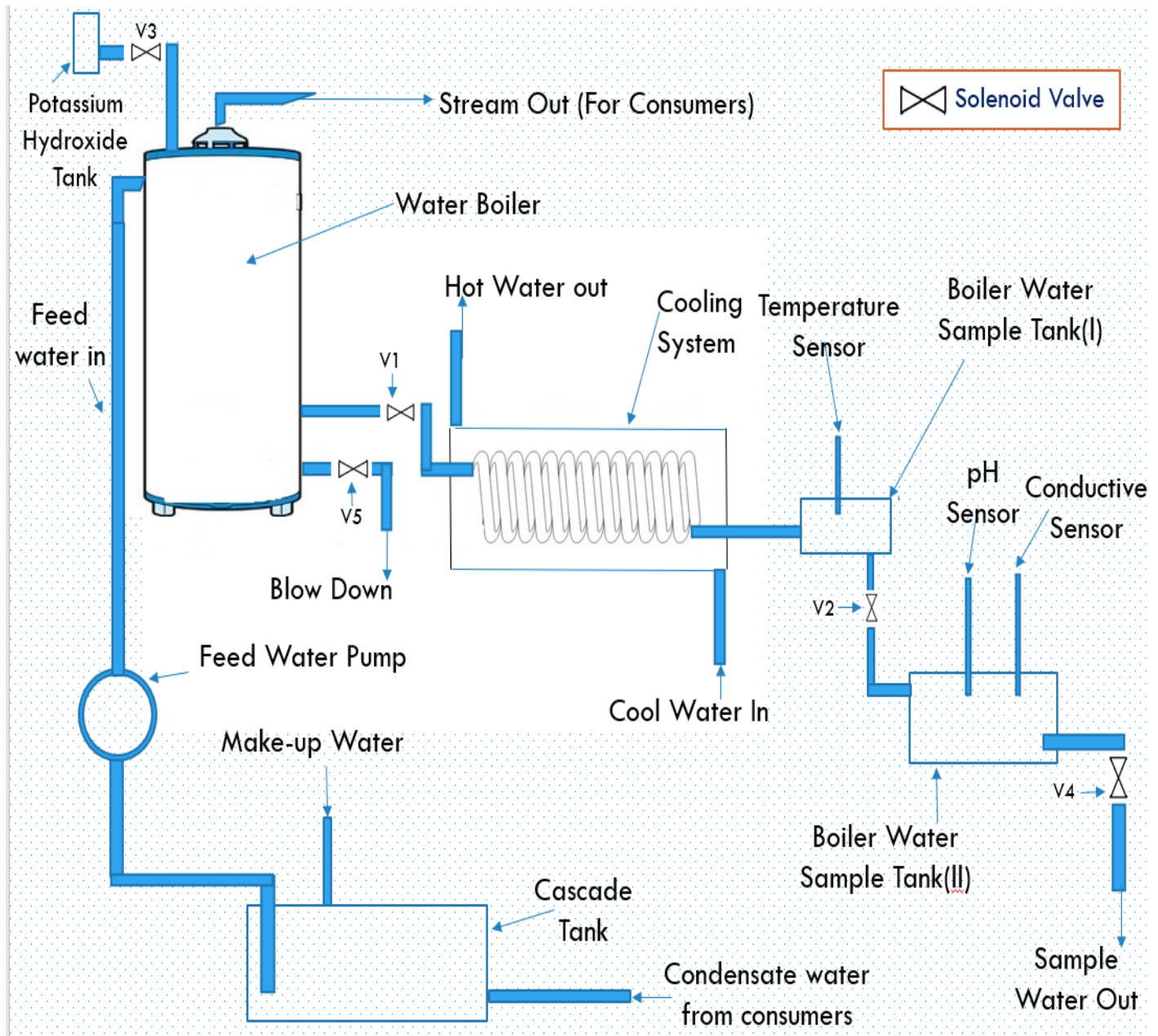
Figure 3.1.1

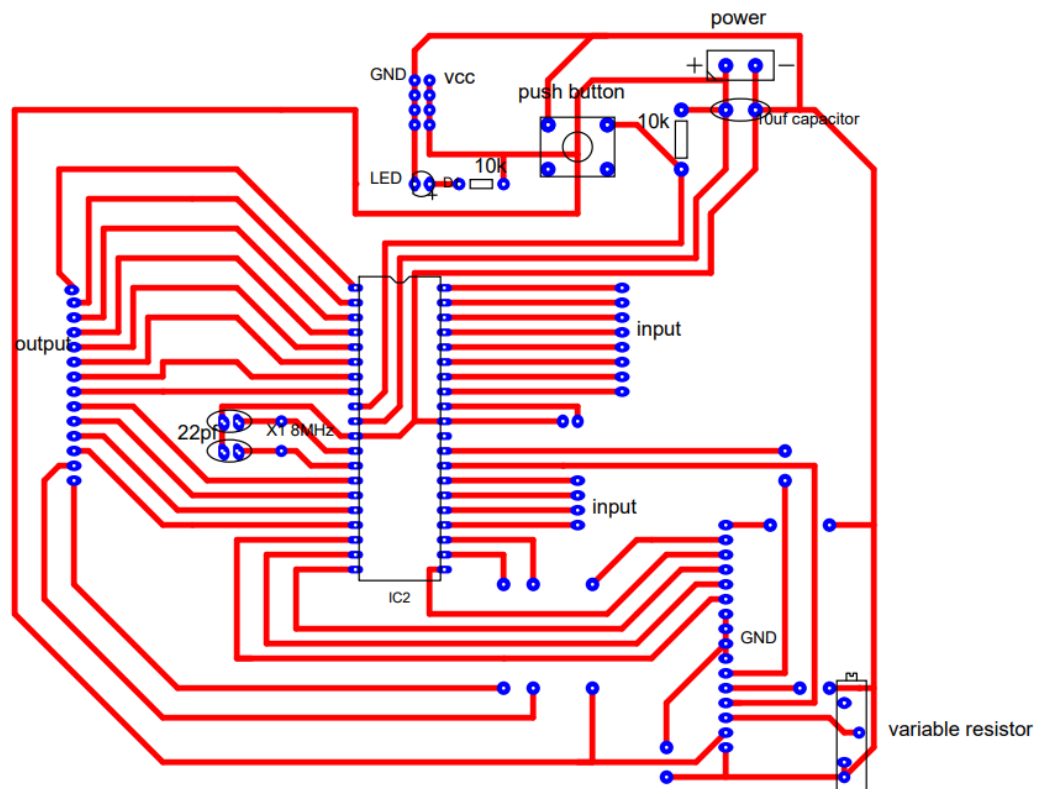## 3.2 Block Diagram

Figure 3.2.1

3.3 Circuit Diagram

Figure 3.3.1

4.0 Testing and Implementation

When we decide to design our project, we have major two difficulties. They are coding part and mechanical part We divide the work upon our group members and then plan the action plan. We follow lots of tutorial videos, books and online videos.

We learnt how to program microcontrollers using Atmel Studio 7.0. we studied how to stimulate the simple basic circuits using Proteus 8.0.
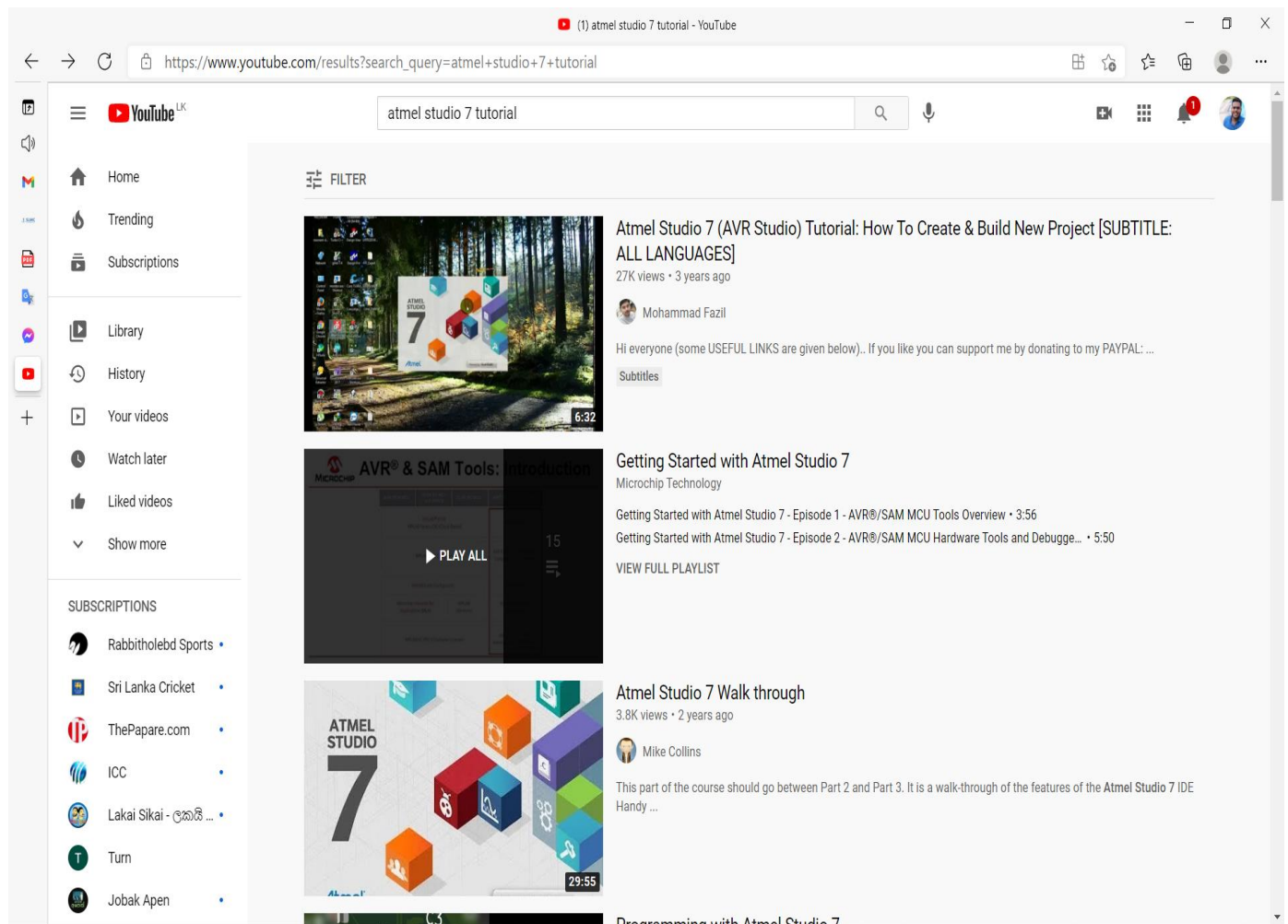

Figure 4.1

We designed the structure of our system. First, we developed the circuit for solenoid valve using Atmega32. Then we wrote coding for the solenoid valves in Atmel studio.

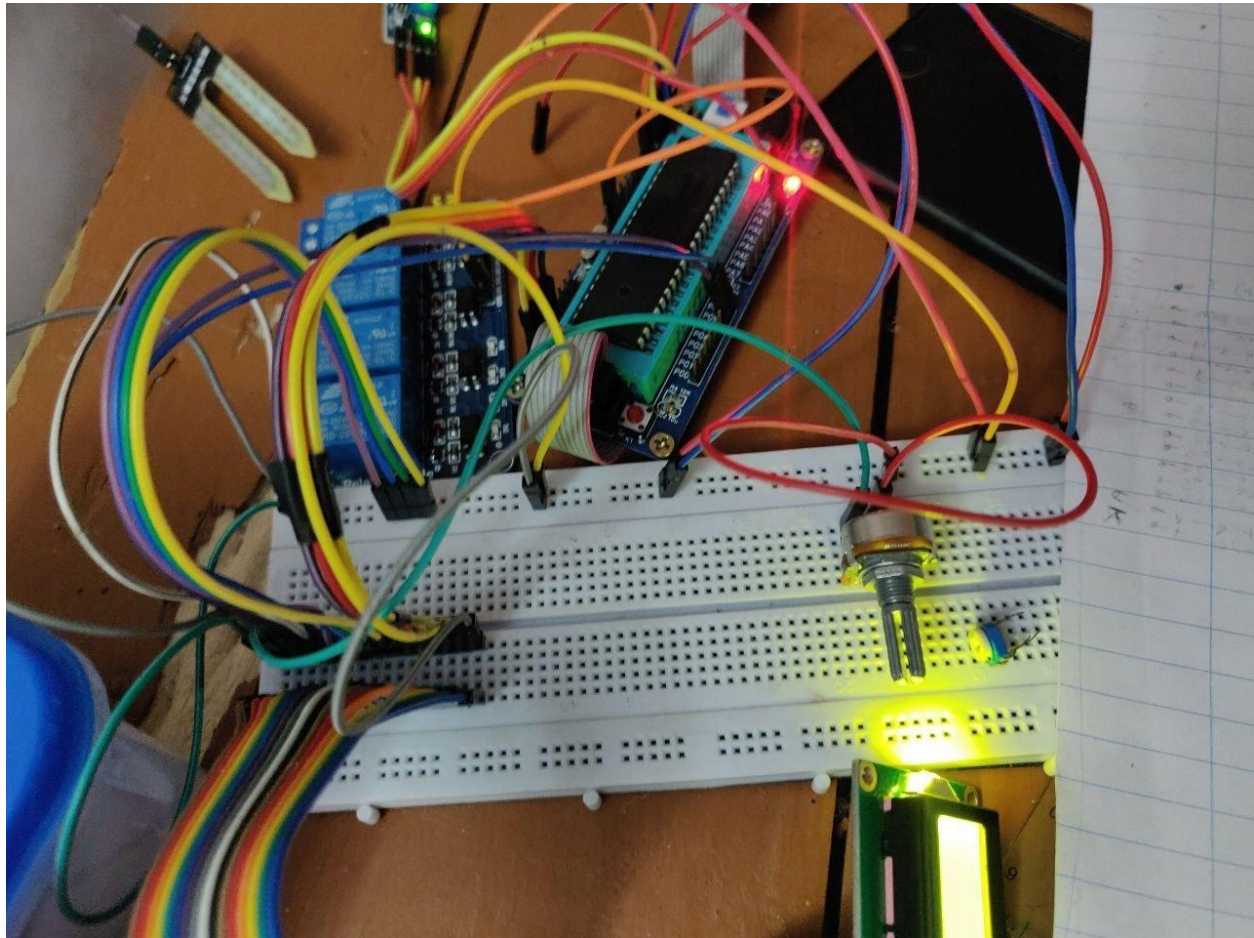Then we connected the coding and designed circuit by using extreme burner AVR. And also, we designed the coding for PH sensor using the Atmel studio software.
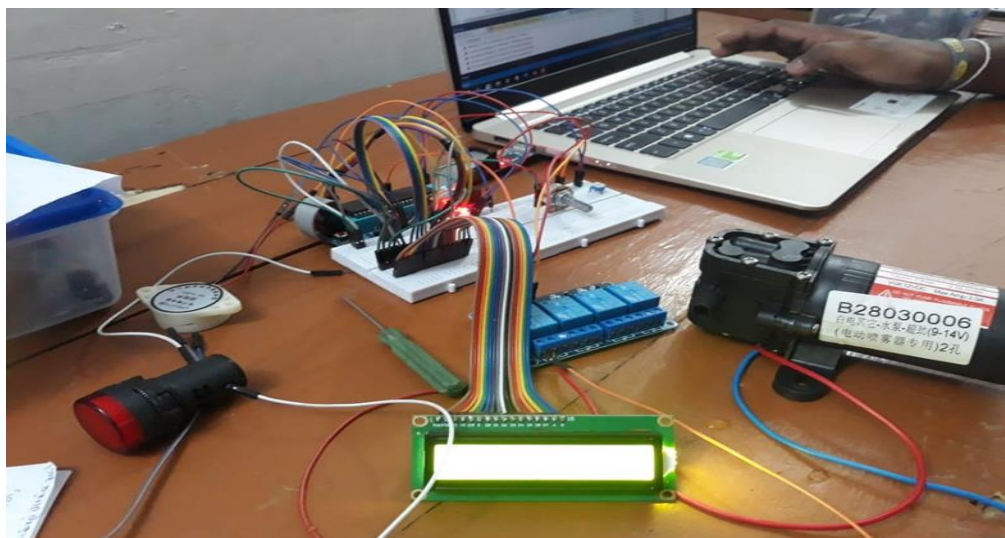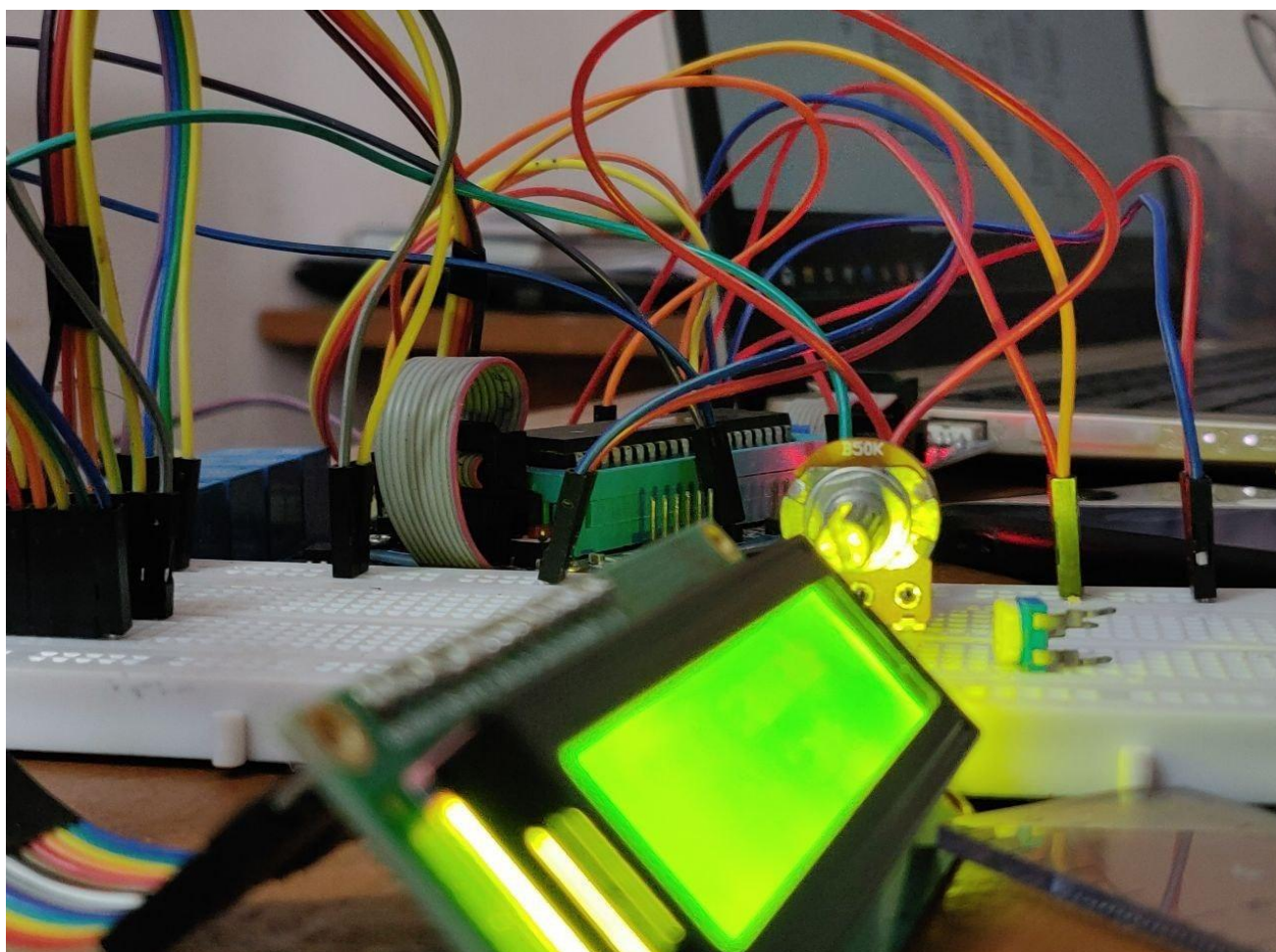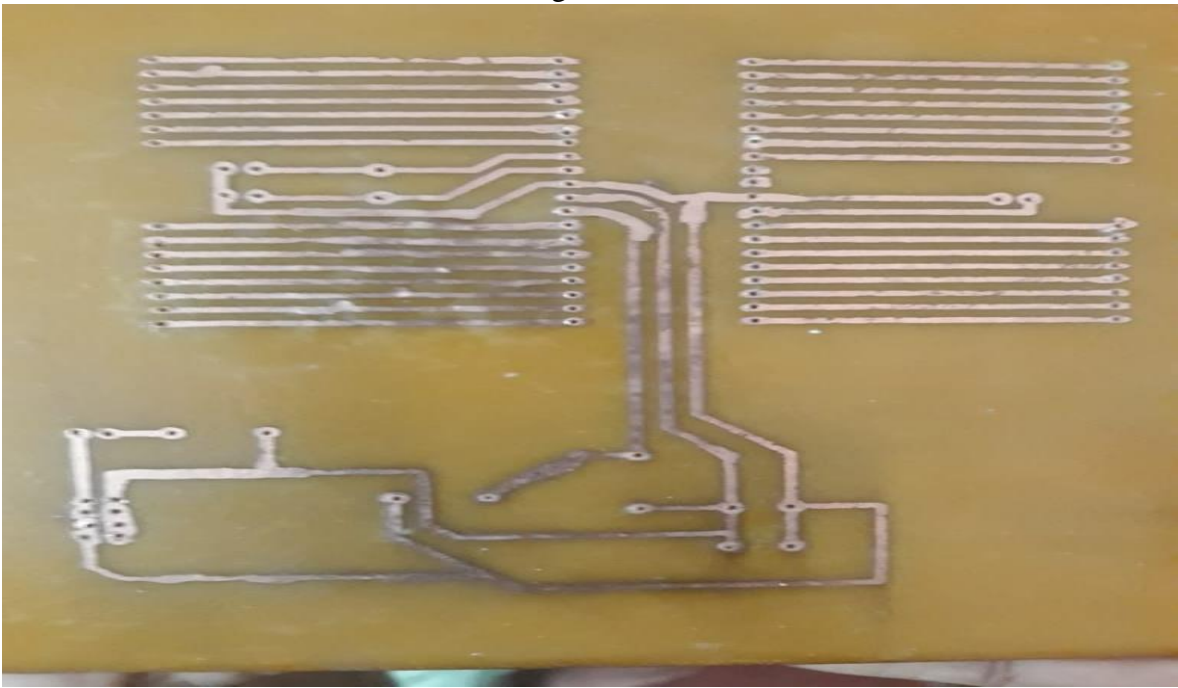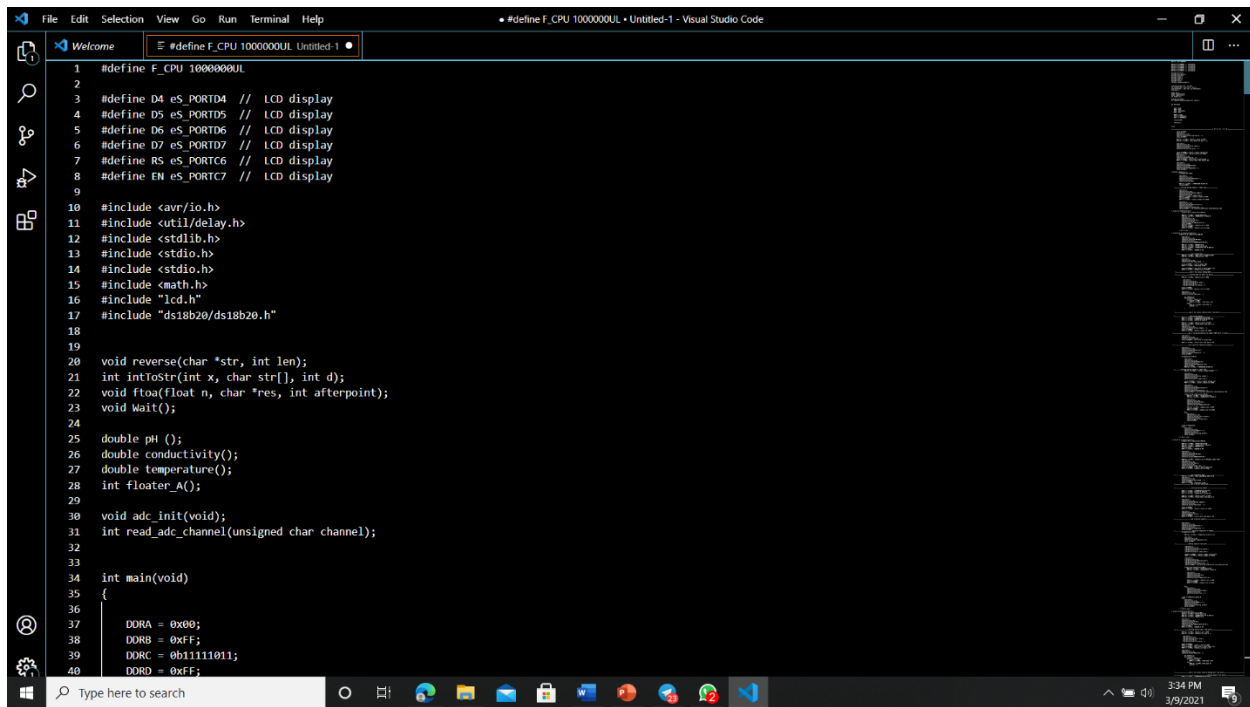

Figure 4.2

Figure 4.3

Figure 4.4

Figure 4.6
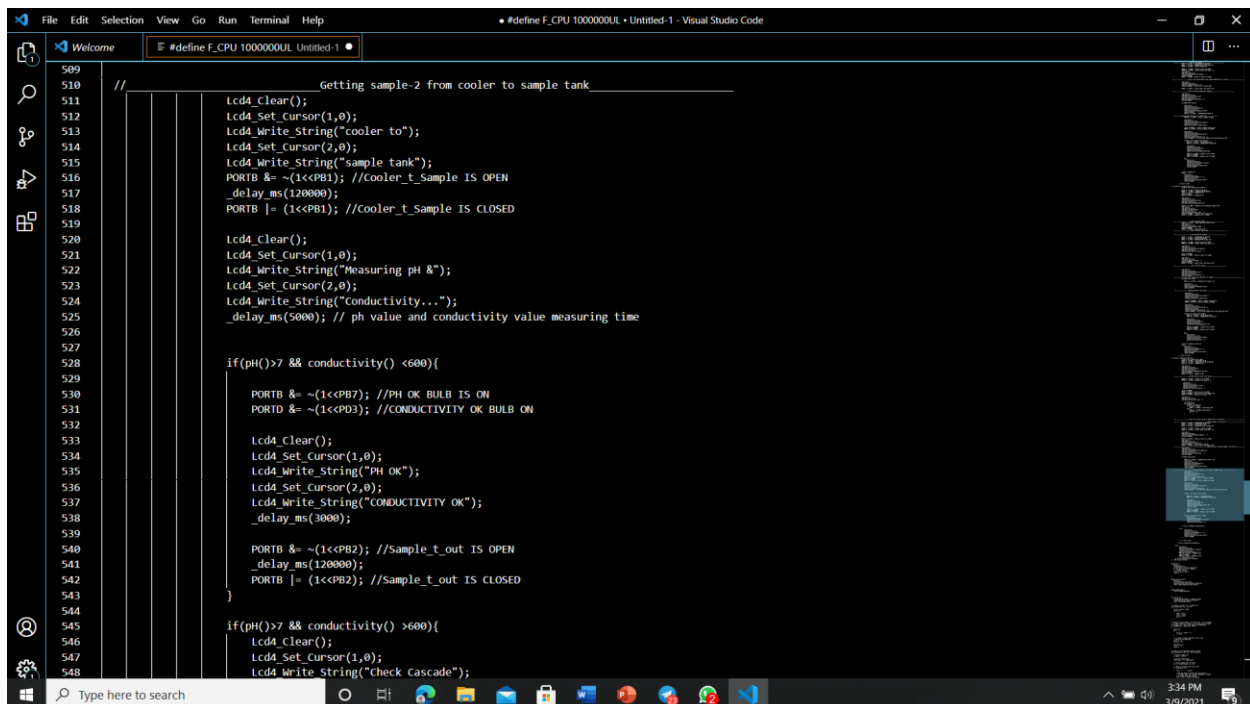
Figure 4.7

```
#define F_CPU 1000000UL

#define D4 eS_PORTD4  //  LCD display
#define D5 eS_PORTD5  //  LCD display
#define D6 eS_PORTD6  //  LCD display
#define D7 eS_PORTD7  //  LCD display
#define RS eS_PORTC6  //  LCD display
#define EN eS_PORTC7  //  LCD display

#include <avr/io.h>
#include <util/delay.h>
#include <stdlib.h>
#include <stdio.h>
#include <stdio.h>
#include <math.h>
#include "lcd.h"
#include "ds18b20/ds18b20.h"


void reverse(char *str, int len);
int intToStr(int x, char str[], int d);
void ftoa(float n, char *res, int afterpoint);
void Wait();

double pH ();
double conductivity();
double temperature();
int floater_A();

void adc_init(void);
int read_adc_channel(unsigned char channel);


int main(void)
{

    DDRA = 0x00;
    DDRB = 0xFF;
    DDRC = 0b11111011;
    DDRD = 0xFF;
```

Figure 4.8

```
//_____Getting sample-2 from cooler to sample tank_____
        Lcd4_Clear();
        Lcd4_Set_Cursor(1,0);
        Lcd4_Write_String("cooler to");
        Lcd4_Set_Cursor(2,0);
        Lcd4_Write_String("sample tank");
        PORTB &= ~(1<<PB1); //Cooler_t_Sample IS OPEN
        _delay_ms(120000);
        PORTB |= (1<<PB1); //Cooler_t_Sample IS CLOSED

        Lcd4_Clear();
        Lcd4_Set_Cursor(1,0);
        Lcd4_Write_String("Measuring pH &");
        Lcd4_Set_Cursor(2,0);
        Lcd4_Write_String("Conductivity...");
        _delay_ms(5000); // ph value and conductivity value measuring time


        if(pH()>7 && conductivity() <600){

            PORTB &= ~(1<<PB7); //PH OK BULB IS ON
            PORTD &= ~(1<<PD3); //CONDUCTIVITY OK BULB ON

            Lcd4_Clear();
            Lcd4_Set_Cursor(1,0);
            Lcd4_Write_String("PH OK");
            Lcd4_Set_Cursor(2,0);
            Lcd4_Write_String("CONDUCTIVITY OK");
            _delay_ms(3000);

            PORTB &= ~(1<<PB2); //Sample_t_out IS OPEN
            _delay_ms(120000);
            PORTB |= (1<<PB2); //Sample_t_out IS CLOSED
        }

        if(pH()>7 && conductivity() >600){
            Lcd4_Clear();
            Lcd4_Set_Cursor(1,0);
            Lcd4_Write_String("Check Cascade");
```

Figure 4.9

5.0 Further work

- ✓ Increase the efficiency and quality of the process.

- ✓ Increase the monitoring parameters. Such as chloride percentage of the water. Because it should be a major cause to rust the boiler and Decomposes the boiler. Also, increase the feed system quality according to new monitoring parameters.

- ✓ Introducing the product to the market by minimizing the cost of production and maximizing the efficiency of cost.

Appendix A

<u>Individual Contribution</u>

01. P.G.V. Dinupriya - 184034M

- ❖ Study about **PH sensor**.
- ❖ Design, implementation and testing Process of the **PH sensor** part.
- ❖ Coding of the **PH sensor** part.
- ❖ Design, implementation and testing in **Cooling System**.
- ❖ Build the **main structure** of the project.

02. K.K.B.R. Kodithuwakku- 184079E

- ❖ Study about **Conductivity sensor**.
- ❖ Design, implementation and testing Process of the **Conductivity sensor** part.
- ❖ Coding of the **Conductivity** sensor part.
- ❖ Design, implementation and testing in **Cooling System**.
- ❖ Build the **main structure** of the project.

03. M.A.T. Gayashan- 184048J

- ❖ Study about **PCB design**.
- ❖ Design, implementation and testing Process of the **PCB** part.
- ❖ Study about **Solenoid Valves and motors**.
- ❖ Coding the **Solenoid Valves and motors**.
- ❖ Design, implementation and testing in **Solenoid Valves and motors**.
- ❖ Build the **main structure** of the project.

04. E. Vanakeethan-184179K

- ❖ Design, implementation and testing Process of the **LED Panel**.
- ❖ Study about **Panel Board**.
- ❖ Design, implementation and testing in **Panel Board**.
- ❖ Study about the **mathematical equation** of the **Cascade tank** and testing.
- ❖ Coding the **panel Board part**.

05. S.Keerthana- 184076R

- ❖ Study about **Temperature sensor**.
- ❖ Design, implementation and testing Process of the **Temperature sensor** part.
- ❖ Coding of the **Temperature** sensor part.
- ❖ Study about **PCB part**.
- ❖ Give support to the **PCB Design, implementation and testing.**

Appendix B- Reference

- ❖ http://www.atmel.com/Images/Atmel-8155-8-bit-Microcontroller-AVR-ATmega32A_Datasheet .pdf

- ❖ https://www.youtube.com

- ❖ Title (springer.com)

- ❖ Conductivity Sensors, Probes & Cells - METTLER TOLEDO (mt.com)

- ❖ Stainless Steel Automatic Thermometer Soap Liquid Dispenser (rakinda.com)

- ❖ Component Search Engine: Free Symbols, footprints, & 3D models