TECHNICAL UNIVERSITY OF MOLDOVA
FACULTY OF COMPUTERS, INFORMATICS AND MICROELECTRONICS
SOFTWARE ENGINEERING AND AUTOMATION DEPARTMENT

Report

Laboratory work nr. 5

Theme: Control

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1. Task of the laboratory work:

Develop an MCU-based application that will implement management systems for

a) regulation of temperature or humidity with the application of the On-Off driving method with hysteresis with relay operation

b) engine speed adjustment with the application of the PID method with an encoder as a sensor, and L298 driver for the application of power to the engine.

NOTE: in (b) you can choose another control parameter, with the constraint that the drive will have a resolution of at least 8 bits.

The set point (control setpoint) will be set from one of the sources of your choice

- a potentiometer
- two buttons for UP / Down
- encoder sensor
- keypad
- serial interface

Setpoint and Current value will be displayed on the LCD,

2. The progress of the work:

2.1 Bloc diagram of program/s

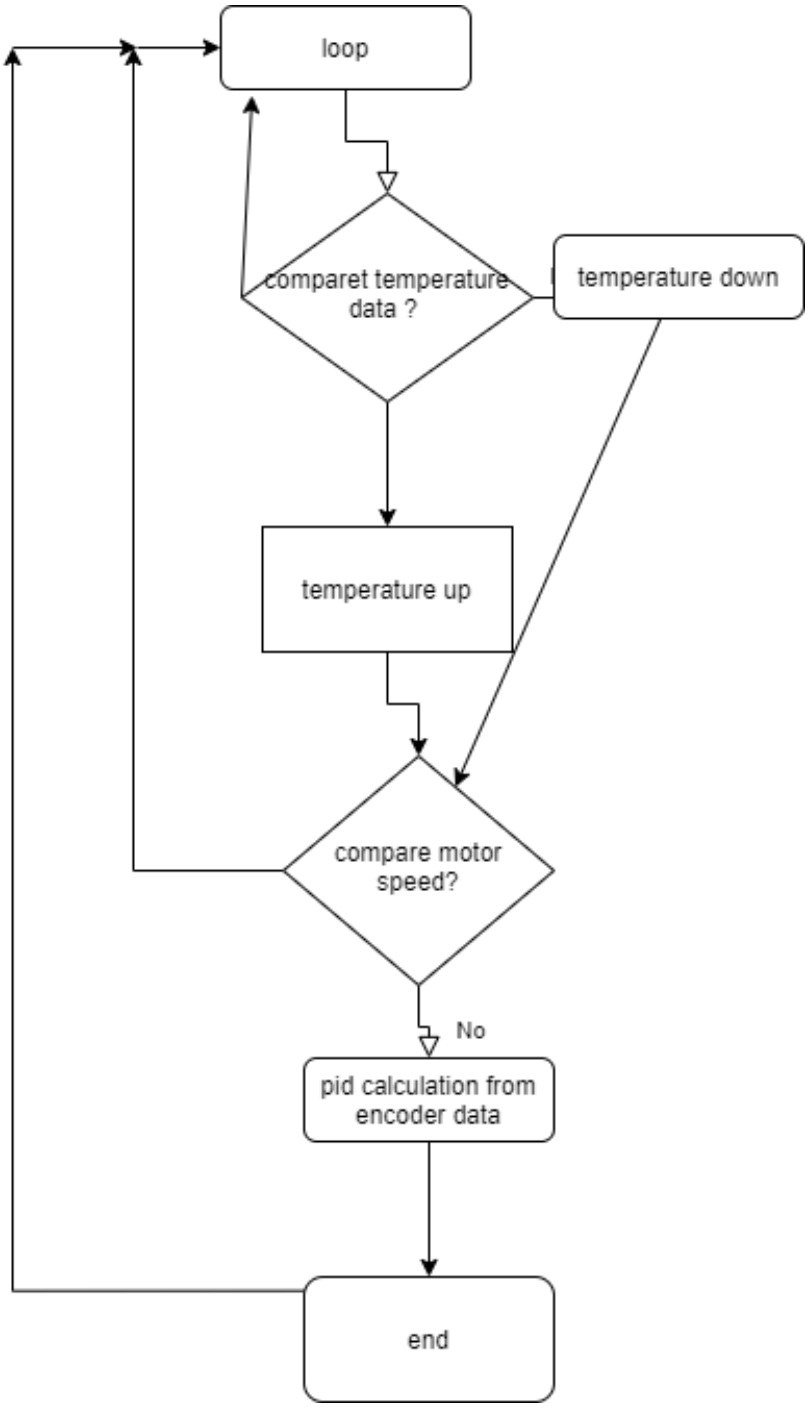

Figure 1 Bloc diagram for task

2.2 Simulated or actually assembled electrical schematic

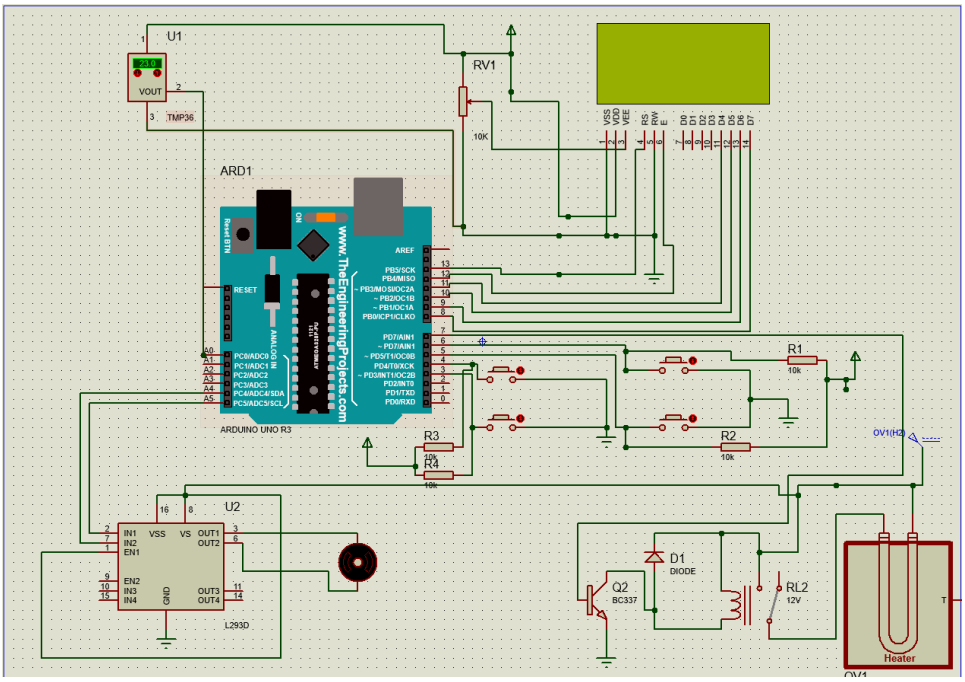

Figure 2 Simulated assembled electrical schematic

2.3 Screenshots of running the simulation program or photos of the real assembled equipment with screenshots of the “terminal” application on the computer

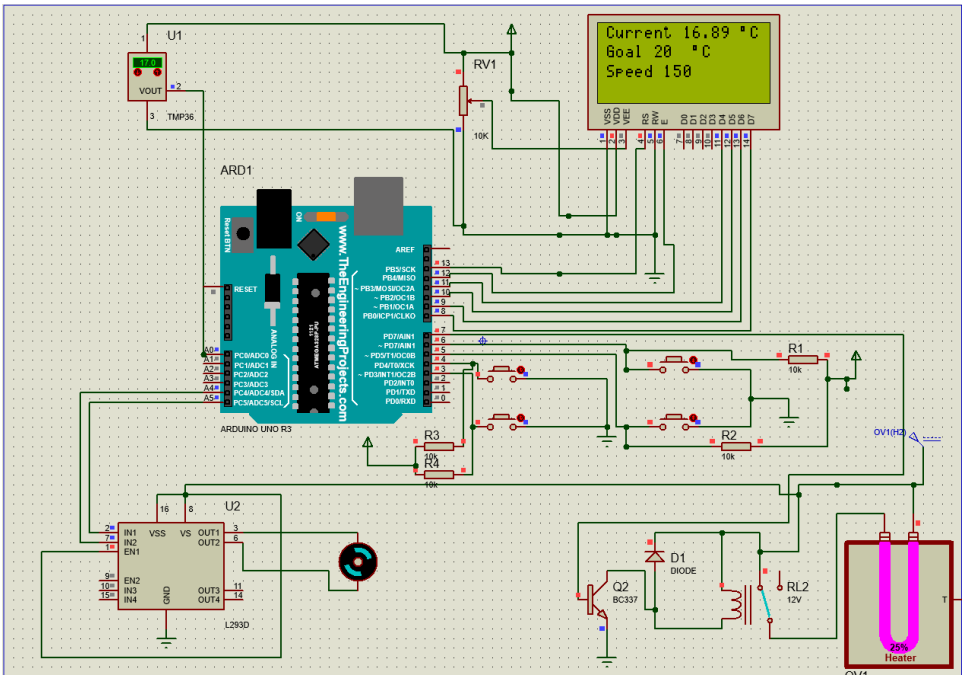

Figure 3 Running simulation program

3. Conclusions:

During this laboratory work I learnt how to make an embedded system. I understood not how to control different devices that have very fast changing parameters and are influenced by environment actions.

Appendix 1

Code:

```
#include <Wire.h>


#include <LiquidCrystal.h>



// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 13,
  en = 12,
  d4 = 11,
  d5 = 10,
  d6 = 9,
  d7 = 8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);


const int buttonPin2 = 6; //button pin for incrementing
const int buttonPin3 = 5; //button pin for decrementing
const int buttonPin4 = 4; //button pin for incrementing
const int buttonPin5 = 3; //button pin for decrementing
const int motorPort1 = A4;
const int motorPort2 = A5;


const int sensorPin = A0;
```

```
const int heaterPort = 7;
int treshold = 20;
int speed = 150;


void setup() {
  // pinMode (aqSensor,INPUT); // MQ135 is connected as INPUT to arduino
  pinMode(7, OUTPUT);
  lcd.begin(16, 4);
  lcd.print("Starting");
  pinMode(buttonPin2, INPUT);
  pinMode(buttonPin3, INPUT);
  pinMode(buttonPin4, INPUT);
  pinMode(buttonPin5, INPUT);
  // delay(1000);
}


void loop() {
  int reading = analogRead(sensorPin);

  if (digitalRead(buttonPin2) == LOW) {
    while (digitalRead(buttonPin2) == LOW) {};
    treshold++;
  }
  if (digitalRead(buttonPin3) == LOW) {
    while (digitalRead(buttonPin3) == LOW) {};
    treshold--;
  }
  if (digitalRead(buttonPin4) == LOW) {
```

```
    while (digitalRead(buttonPin4) == LOW) {};
    speed++;
  }
  if (digitalRead(buttonPin5) == LOW) {
    while (digitalRead(buttonPin5) == LOW) {};
    speed--;
  }



  // converting that reading to voltage, for 3.3v arduino use 3.3
  float voltage = reading * 5.0;
  voltage /= 1024.0;



  // now print out the temperature
  float temperatureC = (voltage - 0.5) * 100; //converting from 10 mv per degree
with 500 mV offset
  lcd.setCursor(0,                                          0);lcd.print("Current
");lcd.print(temperatureC);lcd.println(F(" \xDF""C"));
  lcd.setCursor(0,                                             1);lcd.print("Goal
");lcd.println(treshold);lcd.print(F("\xDF""C"));
  lcd.setCursor(0, 2);lcd.print("Speed ");lcd.println(speed);


  if (temperatureC < treshold) {
    digitalWrite(heaterPort, HIGH);
    analogWrite(motorPort2, 0);
    analogWrite(motorPort1, 0);
  }
  if (temperatureC > treshold) {
    digitalWrite(heaterPort, LOW);
```

```
    analogWrite(motorPort2, speed);
    analogWrite(motorPort1, 0);
  }
}
```