

**University of Montenegro
Faculty of Electrical Engineering
Podgorica**

Laboratorijske vježbe iz predmeta Industrijska elektronika

**On-Off Regulator Temperature
On-Off Temperature Regulator
(Vježba 5)**

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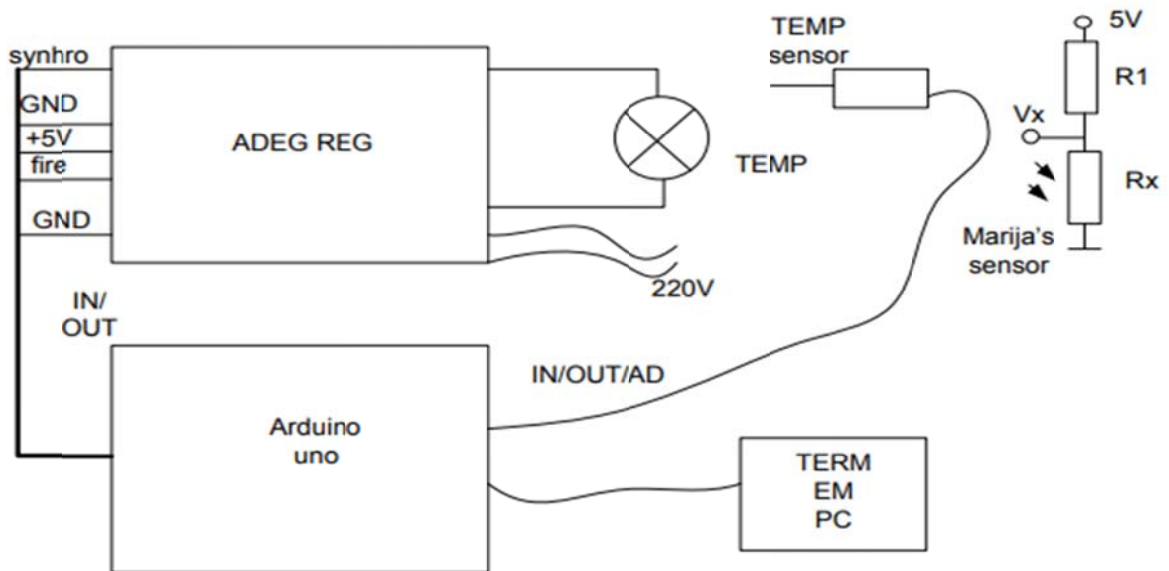
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Zadatak i rešenje:

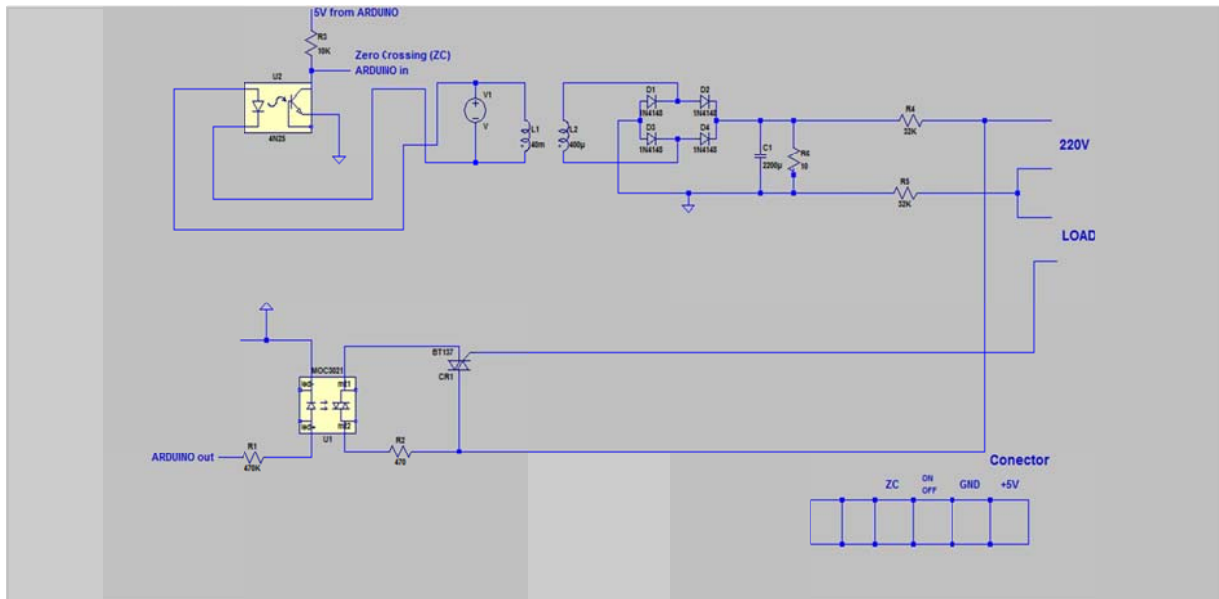
Sijalica je povezana na Arduino Uno preko posebno dizajniranog kola za sinhronizaciju. To kolo je povezano na Arduino kome se šalju informacije o vrijednostima temperature koju mjeri temperaturni senzor iznad sijalice.

Kada se startuje program, na serijskom monitoru se čeka unos komande ON koja startuje program. Ako ne unesemo željenu temperaturu, podrazumijevana temperatura je 38°C. Ako želimo da zaustavimo program, kucamo komandu OFF.

Arduino kod je naveden na sledećim stranama.



**SINHRO
CIRCUIT**



Slika1. ADEG REG sinhronizacijo kolo. LT Spice.

Abstract:

Temperature regulation:

Temperature regulation example given in this project is one solution of the problem located in almost every industrial mission. Needless to say, but regulation of temperature is crucial factor in monitoring health issues, facility production, environment conditions and so on. Most importantly, it is useful in providing those conditions to humans, animals and plants. Usually, this regulator is found in incubators that are not only the boxes where you keep something warm and protected. Modern incubators (for premature babies, animals such as chickens...) are equipped with wide variety of sensors and regulators. Temperature regulator that we made and explained here is one of them.

If the incubator where chicken eggs are kept is at the incorrect temperature and humidity levels for a sufficient length of time (or if levels continually change), it interferes with the normal growth and development of the embryo, and unfortunately can stop the embryo developing further.

Generally, the temperature in incubator should be maintained between 37 and 39 degrees Celcius. Attempting to overheat the hen incubator in order to speed up the process will result in speeding up the development of the embryo, but will also reduce the chance of hatchability and can also result in abnormal chicks. A longer period of low temperatures, however, can result in dead embryos.

A good quality incubator should have a powerful temperature control where the temperature can be adjusted accordingly, and the accuracy is pretty much spot on.

Kod:

Značajne linije koda su opisane pod komentarima.

```
#include "VernierLib.h"
VernierLibVernier;
floatsensorReading;// definisemo prom dje smjestamo podatke sa temp. senzora;
String inputString = "";// definisemo string u koji smjestamo ono sto unesemo u Serial Monitor
booleanstringComplete = false;

intztemp=0;// definisemo prom dje smjestamo vrijednost zeljene temp.
intizlaz=3; // definisemo da preko pina D3 kontrolisemo rad sijalice

void setup() {
Vernier.autoID();
Serial.begin(9600);
pinMode(izlaz, OUTPUT);// definisemo pin D3 kao izlazni
inputString.reserve(200);
}
void loop() {

if (stringComplete) {
Serial.println(inputString);
inputString = "";
stringComplete = false;
}
if(inputString=="OFF"){
digitalWrite(izlaz, LOW);
}
else if(inputString!="" &&inputString!="OFF"){
if(inputString.toInt()==0){
ztemp=38;
}
else{
ztemp=inputString.toInt();
}
Serial.print("Specificiranatemperatura= ");
Serial.print(ztemp);
Serial.print(" ");
Serial.println(Vernier.sensorUnits());
sensorReading =Vernier.readSensor();
Serial.print(" Trenutnatemperatura= ");
Serial.print(sensorReading);
Serial.print(" ");
Serial.println(Vernier.sensorUnits());

if(sensorReading>=(ztemp-1)){
digitalWrite(izlaz, LOW);// Kada je temp dostigne vrijednost zeljene temp. sijalica se gasi
}
else{
digitalWrite(izlaz, HIGH); // Akonije temp dostigla vrijednost zeljene temp. sijalica se pali
}
delay(1000);
```

```
}  
}
```

```
void serialEvent() {
```

```
  inputString=""; // oslobadjamo string koji sakuplja karaktere koje unosimo u Serial Monitor
```

```
  while (Serial.available()) {
```

```
    // sakuplja karaktere koje unesemo u Serijski Monitor
```

```
    char inChar = (char)Serial.read();
```

```
    // dodajete karaktere u string inputString
```

```
    inputString += inChar;
```

```
  if (inChar == '\n') {
```

```
    stringComplete = true;
```

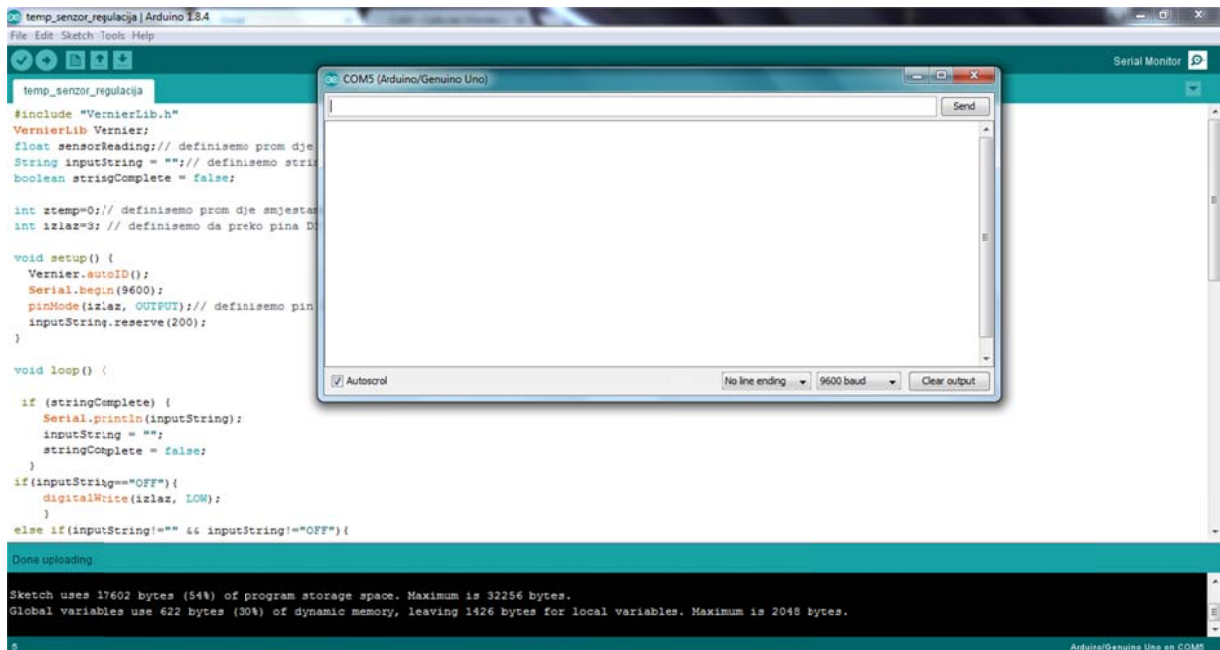
```
  }
```

```
}
```

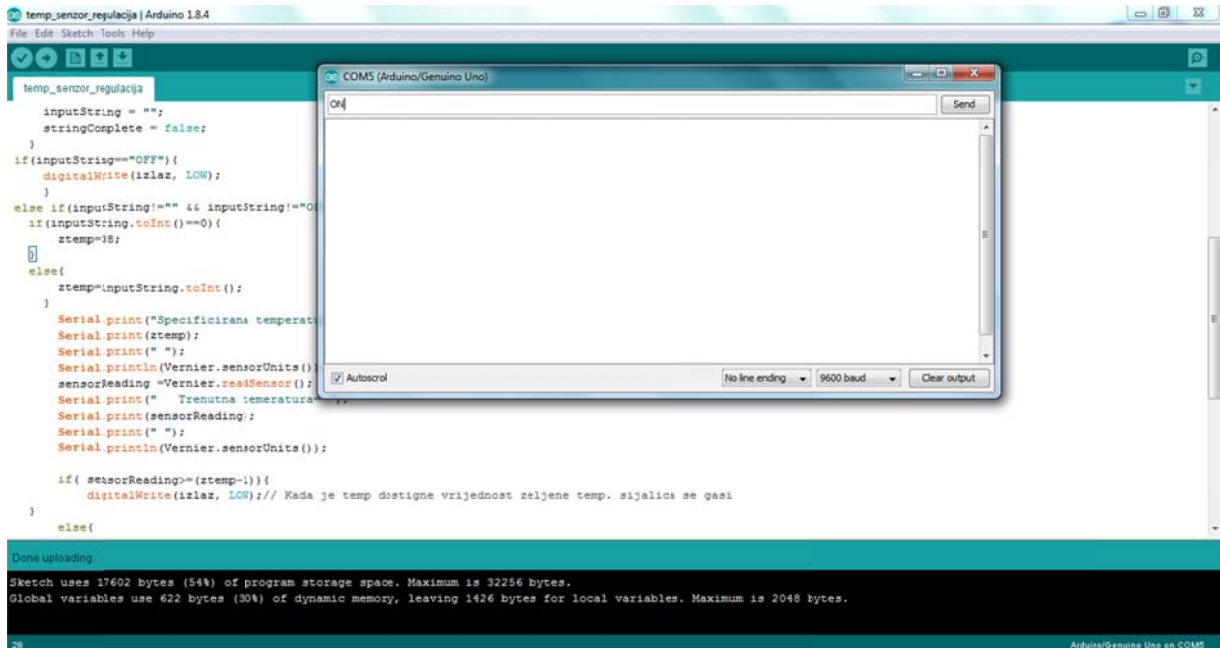
```
}
```

Objašnjenje rešenja:

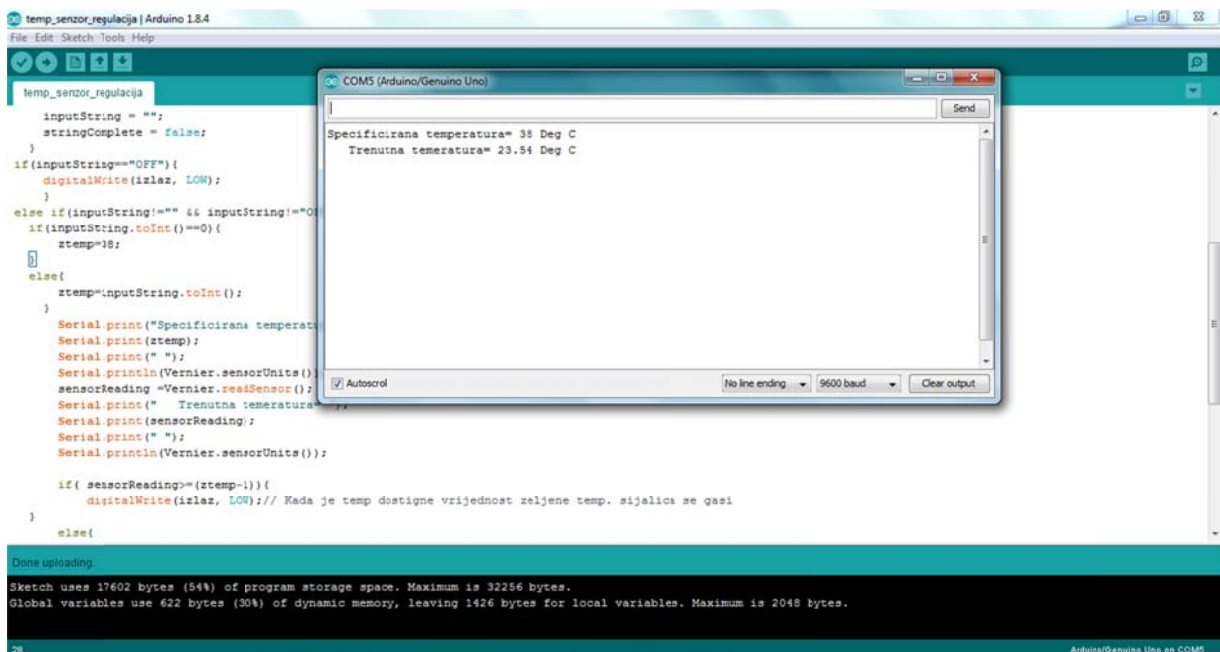
Prikazivanje primljenih vrijednosti (Slika4. i Slika5.) senzora počinje kucanjem komande ON (Slika3.) na Serijskom Monitoru i traje sve do kucanja komande OFF (Slika5.). Alarmantna vrijednost temperature je postavljena na 38 stepeni Celzijusovih (Slika6. i Slika7.). Temperatura se mijenja zbog zagrijavanja sijalice koja se nalazi ispod temperaturnog senzora.



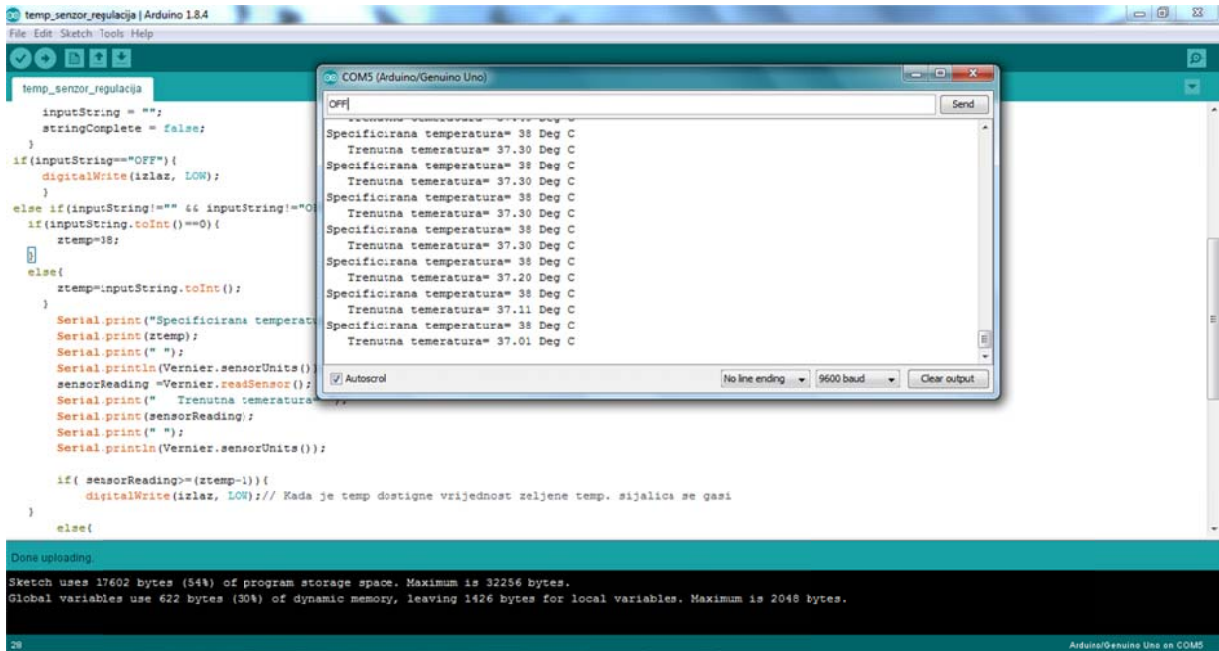
Slika1. Arduino IDE i Serijski Monitor pri pokretanju programa



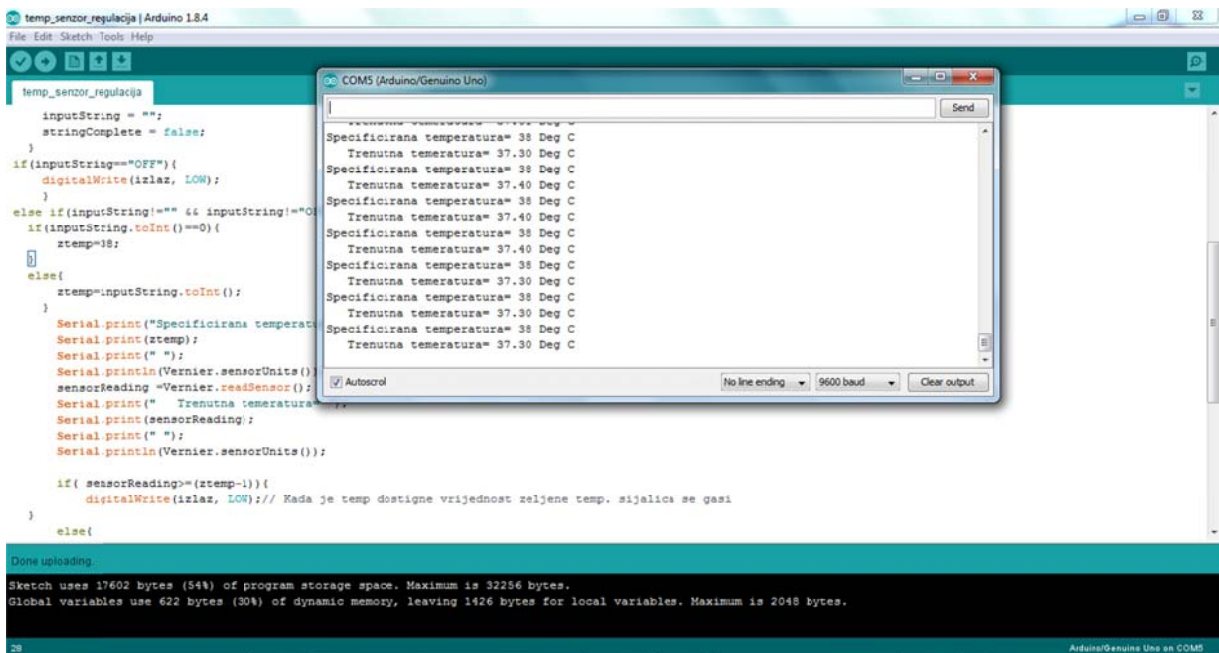
Slika3. Dozvola za prikazivanje mjerenih vrijednosti



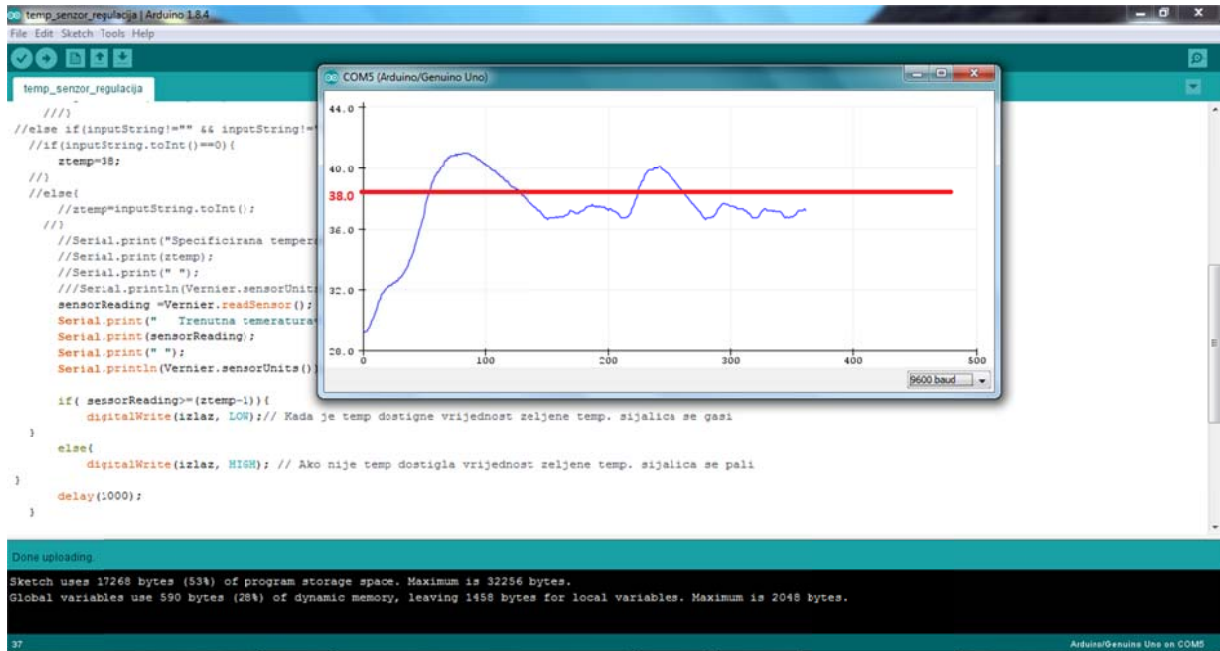
Slika4. Prikazivanje izmjerenih vrijednosti



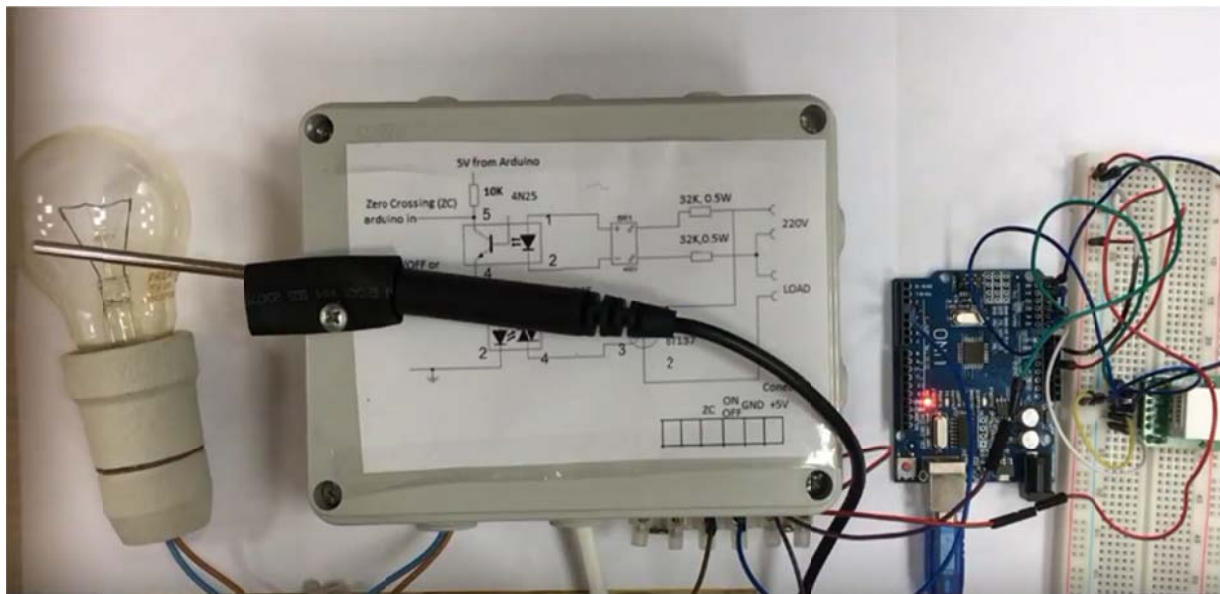
Slika5. Prikazivanje izmjerenih vrijednosti sve do komande OFF



Slika6. Dostignuta zadata alarmanta vrijednost



Slika7. Varijacije temperature i dostizanje alatmante vrijednosti. Grafički monitor.



Slika8. Temperaturni regulator.

Youtube link snimka: <https://www.youtube.com/watch?v=03x8nrGFyY0>

Literatura:

1. T. E. Kissell, Industrial Electronics, Third edition, Prentice Hall, 2003
2. S. A. Karr, T. E. Kissell, R. C. Overstreet. T.W. Wylie, Laboratory Manual to accompany Industrial Electronics, Third edition, Prentice Hall, 2003
3. <http://apeg.ac.me/nastava/Lab1%20INDEL%202018.pdf>
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