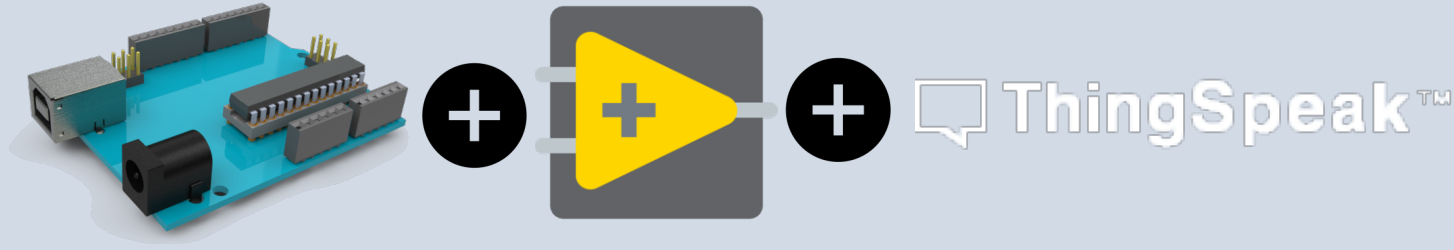


<https://www.halvorsen.blog>



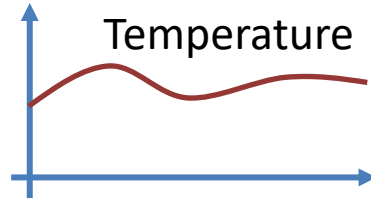
LabVIEW LINX, Arduino and ThingSpeak

Hans-Petter Halvorsen

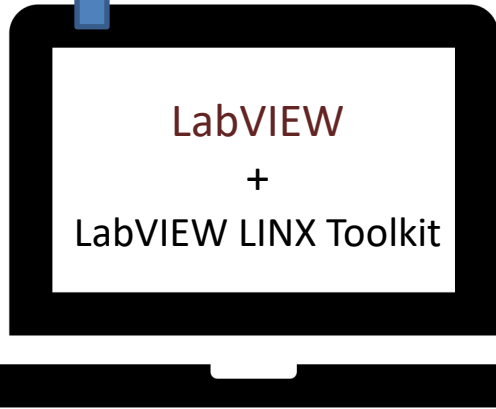
Table of Contents

- Arduino
- ThingSpeak
- LabVIEW
- LabVIEW LINX
- Example
 - Write Data to ThingSpeak using a TMP36 Temperature Sensor

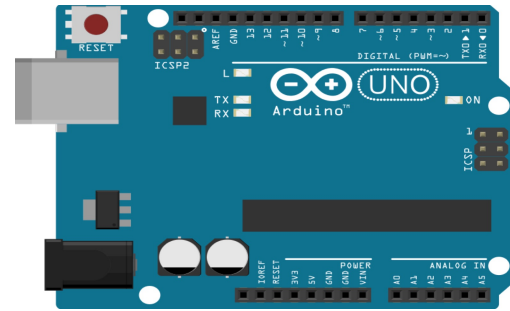
System Overview



PC



Arduino UNO



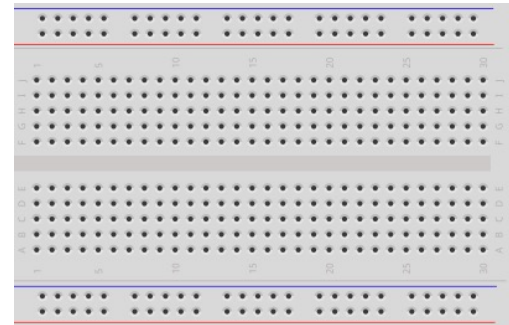
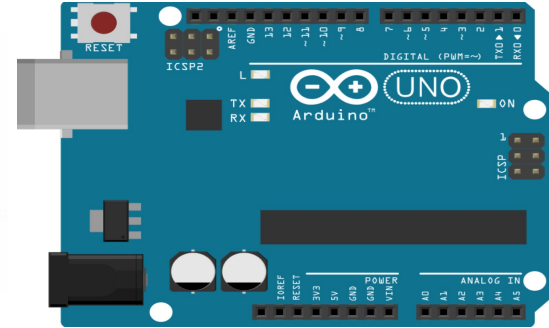
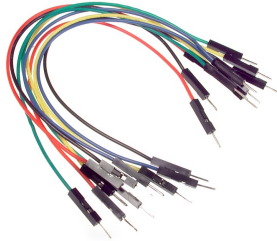
Sensors



TMP36
Temperature Sensor

Hardware

- Arduino
- Breadboard
- Wires (Jumper Wires)
- TMP36 Temperature Sensor





Arduino

Hans-Petter Halvorsen

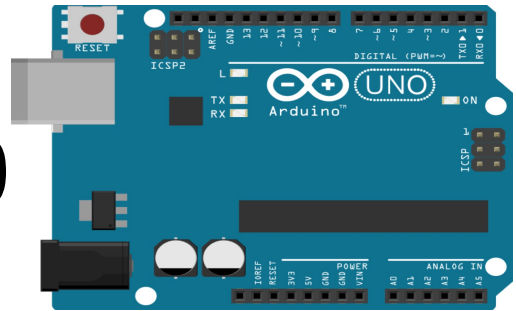
[Table of Contents](#)

Arduino

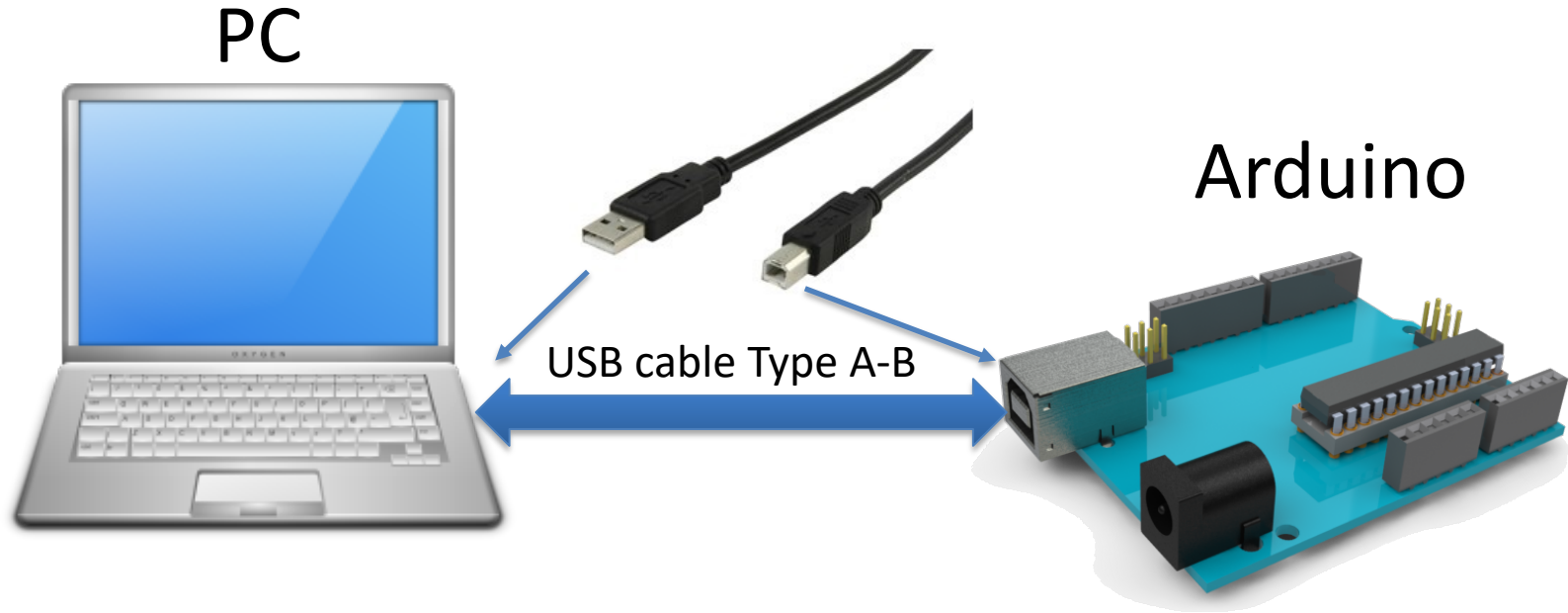
- Arduino is an open-source electronics platform based on easy-to-use hardware and software.
- It's intended for anyone making interactive projects, from kids to grown-ups.
- You can connect different Sensors, like Temperature, etc.
- It is used a lots in Internet of Things projects
- Homepage:
<https://www.arduino.cc>

Arduino

- Arduino is a Microcontroller
- Arduino is an open-source platform with Input/Output Pins (Digital In/Out, Analog In and PWM)
- Price about \$20
- Arduino Starter Kit ~\$40-80
with Cables, Wires, Resistors, Sensors, etc.



Connect Arduino to your PC



Arduino Software

Upload Code to Arduino Board

Save

Open Serial Monitor

Compile and Check
if Code is OK

Open existing Code

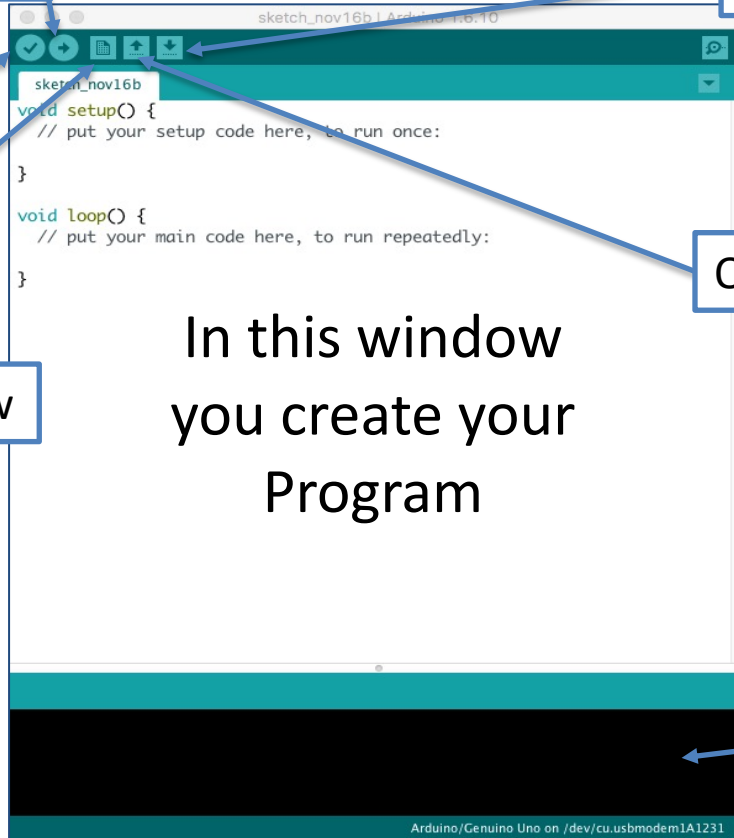
Creates a New Code Window

In this window
you create your
Program

The software can be
downloaded for free:

www.arduino.cc

Error Messages
can be seen here



Arduino Programs

All Arduino programs must follow the following main structure:

```
// Initialization, define variables, etc.  
  
void setup()  
{  
    // Initialization  
    ...  
}  
  
void loop()  
{  
    //Main Program  
    ...  
}
```



ThingSpeak

ThingSpeak

- ThingSpeak is an IoT analytics platform service that lets you collect and store sensor data in the cloud and develop Internet of Things (IoT) applications.
- ThingSpeak has a free Web Service (REST API) that lets you collect and store sensor data in the cloud and develop Internet of Things applications.
- It works with Arduino, Raspberry Pi, MATLAB and LabVIEW, Python, etc.

<https://thingspeak.com>

ThingSpeak

Work

Channel ID: | temperature
Author:
Access: Public

Private View **Public View** Channel Settings Sharing API Keys Data Import / Export

[+ Add Visualizations](#) [+ Add Widgets](#) [Export recent data](#)

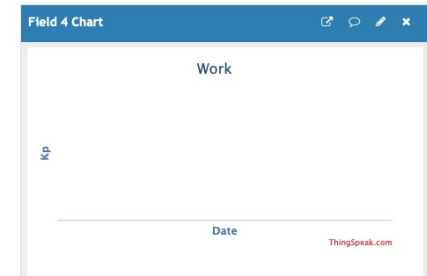
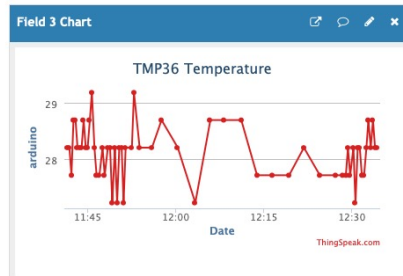
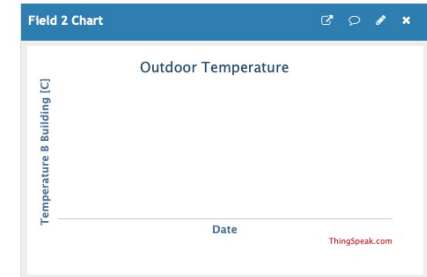
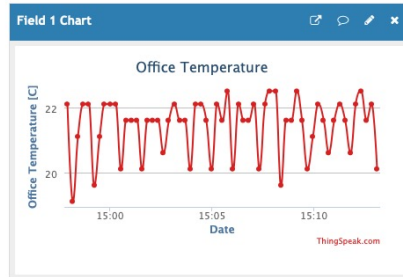
[MATLAB Analysis](#) [MATLAB Visualization](#)

[More Information](#)

Channel 1 of 3 < >

Channel Stats

Created: 4 years ago
Last entry: less than a minute ago
Entries: 242



<https://thingspeak.com>



LabVIEW

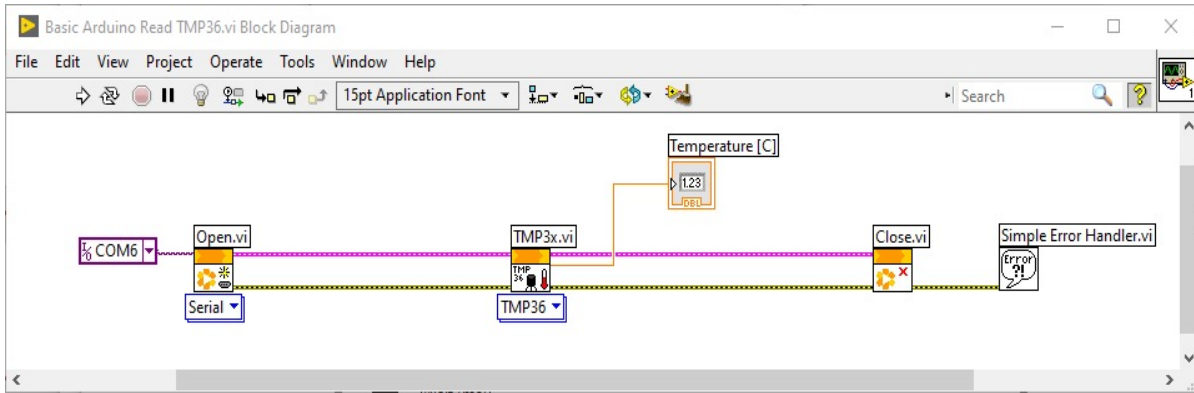
Hans-Petter Halvorsen

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LabVIEW

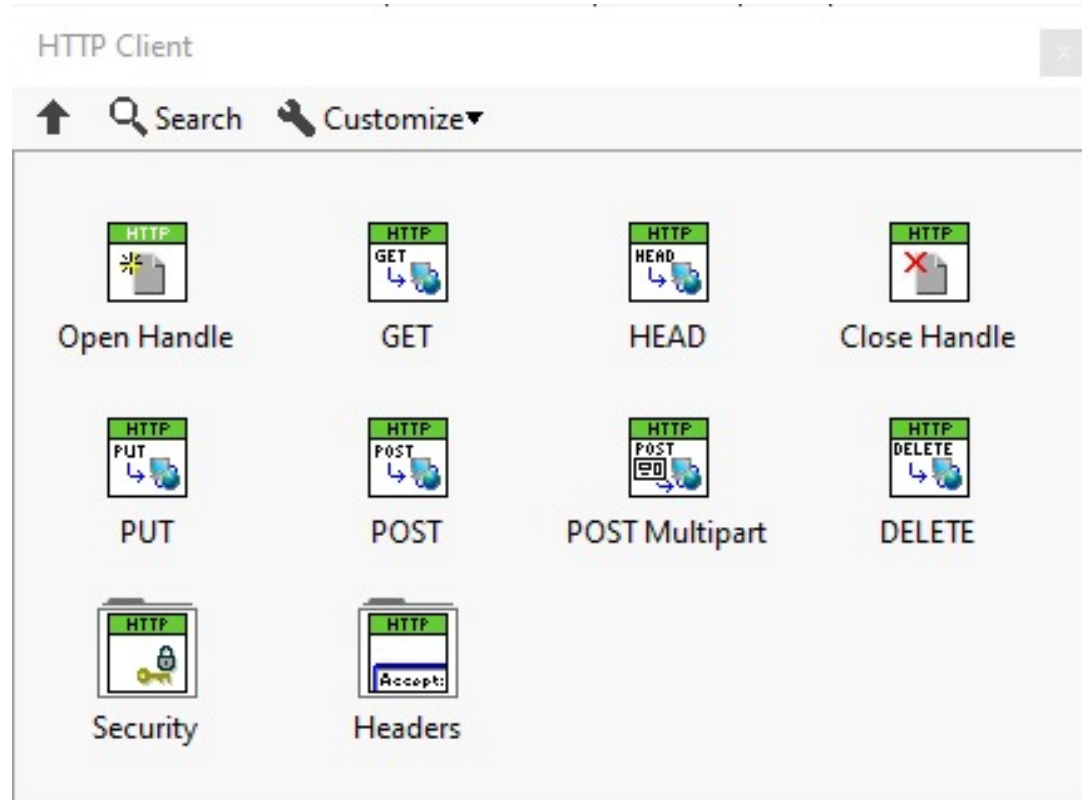
- LabVIEW is Graphical Software
- LabVIEW has powerful features for Simulation, Control and DAQ Applications

Basic LabVIEW Example:



LabVIEW HTTP Client

We can use the built-in LabVIEW HTTP Client Functions in order to communicate with the ThingSpeak REST API



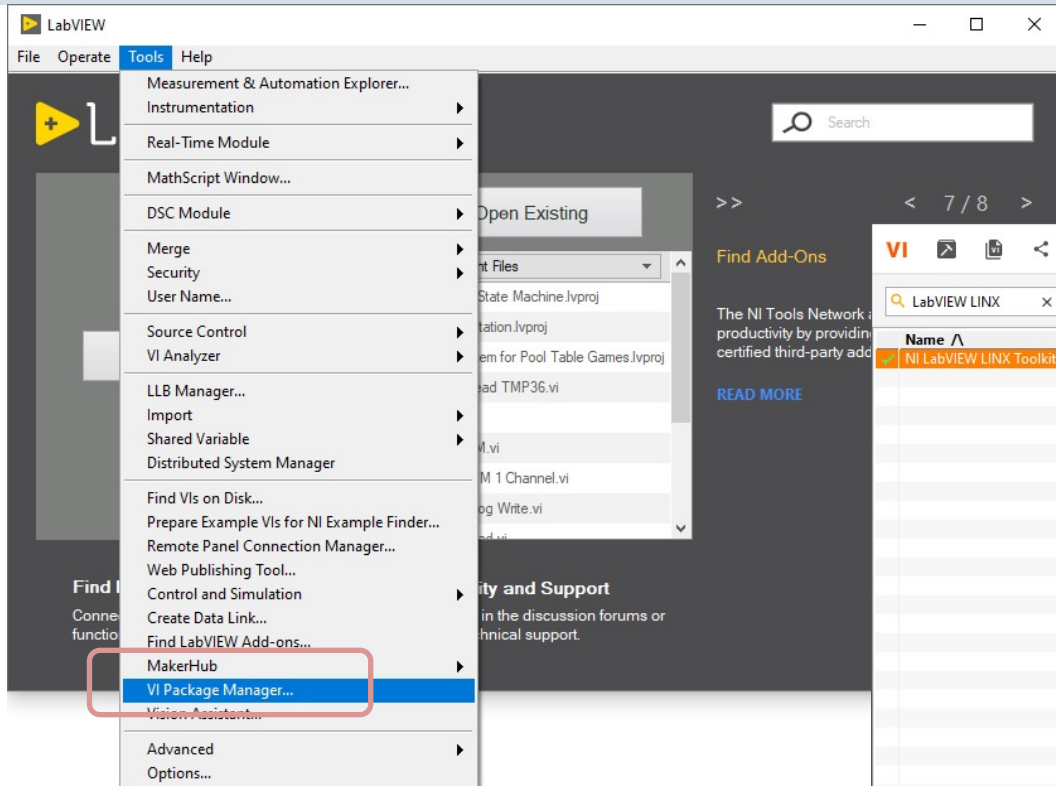


LabVIEW LINX

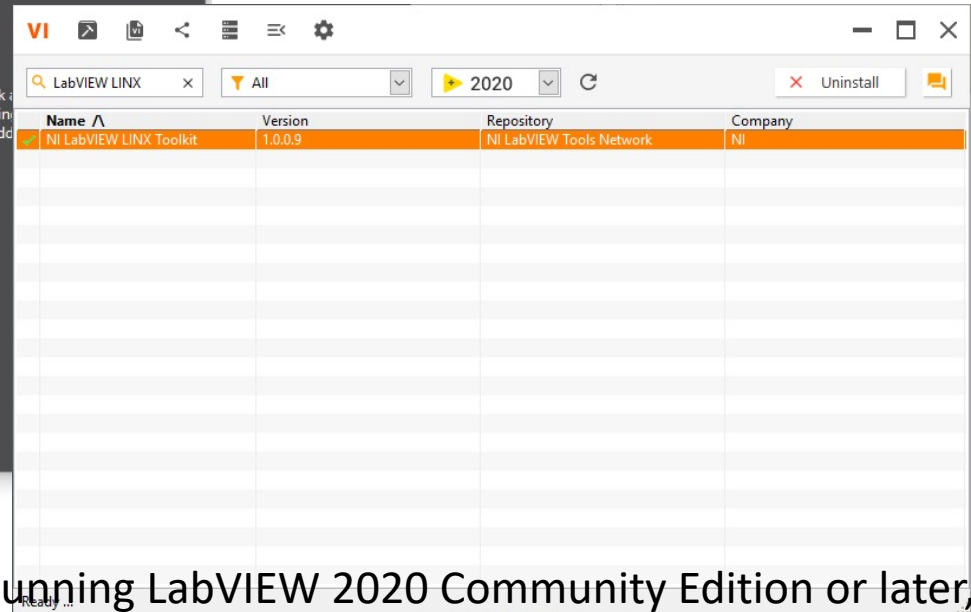
LabVIEW LINX Toolkit

- The LabVIEW LINX Toolkit adds support for Arduino, Raspberry Pi, and BeagleBone embedded platforms
- We will use an **Arduino Uno** in this Tutorial

Installing LabVIEW LINX Toolkit

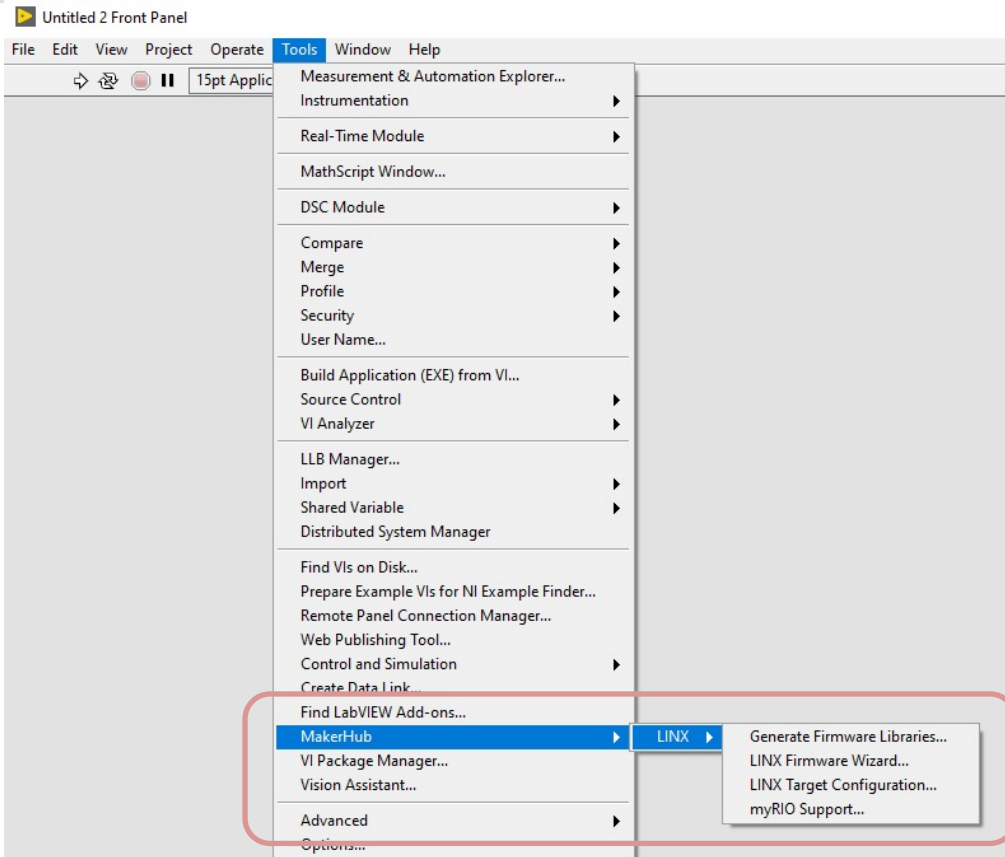


Use VI Package Manager



Note: Do not install this package if you are running LabVIEW 2020 Community Edition or later, as the Community Edition already includes the LabVIEW LINX Toolkit

LabVIEW LINX



Note! In order to use Arduino with LabVIEW LINX you need to update the Firmware on the Arduino device

LINX Firmware Wizard

LINX Firmware Wizard


LINX
Firmware Wizard

LabVIEW
MakerHub

Device Family
Arduino

Device Type
Arduino Uno

Firmware Upload Method
Serial / USB



Help Settings Next Cancel

Note! In order to use Arduino with LabVIEW LINX you need to update the Firmware on the Arduino device

LabVIEW LINX Palette

Sensors

↑ Search Customize

- Accelerometer
- Beta
- Community
- Display
- Distance
- Digilent
- Lights
- Mindstorms
- Misc
- Motion
- Pmods
- Temp
- Sig Gen

LINX

↑ Search Customize

- Open
- Close
- Peripherals
- Sensors
- Utilities

Peripherals

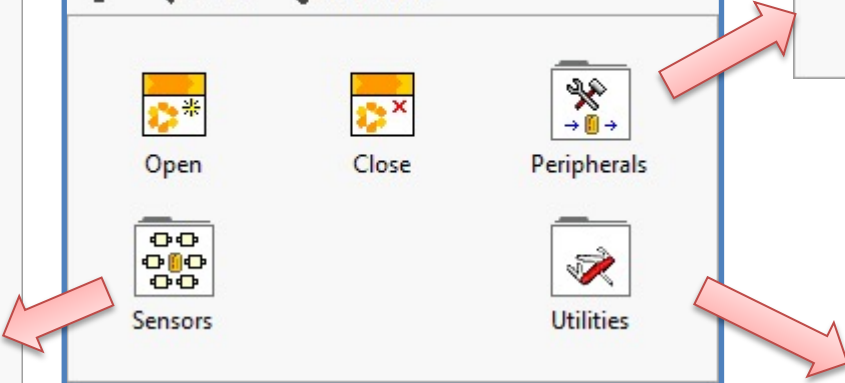
↑ Search Customize

- Analog
- Digital
- PWM
- I2C
- SPI
- UART

Utilities

↑ Search Customize

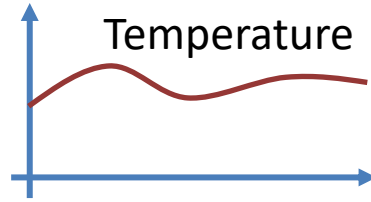
- Custom CMD
- Loop Freq
- Check Channel
- Get User ID
- Set User ID
- Config Enet
- Config Wifi



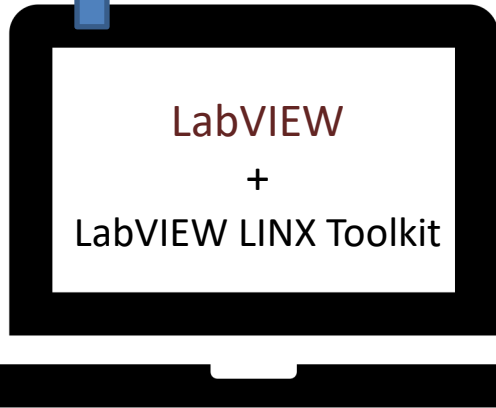


TMP36 Example

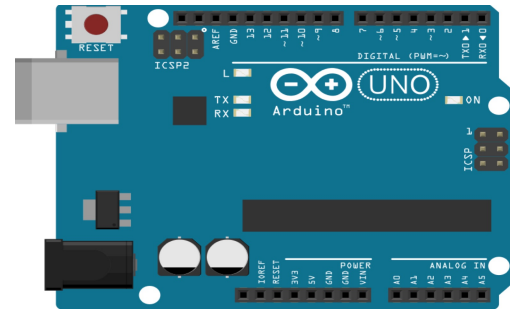
System Overview



PC



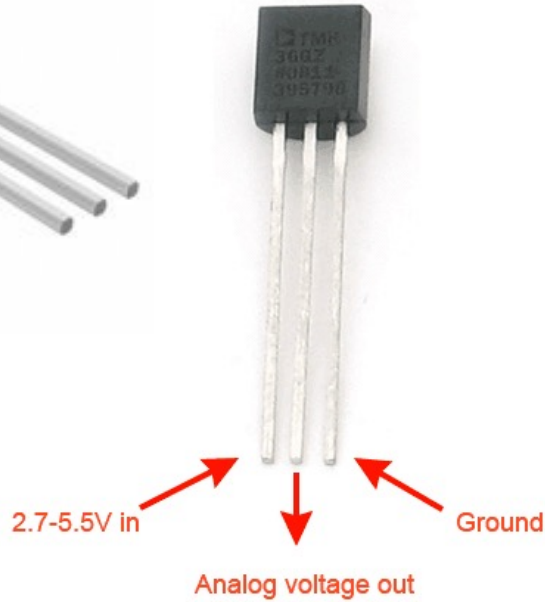
Arduino UNO



Sensors



TMP36



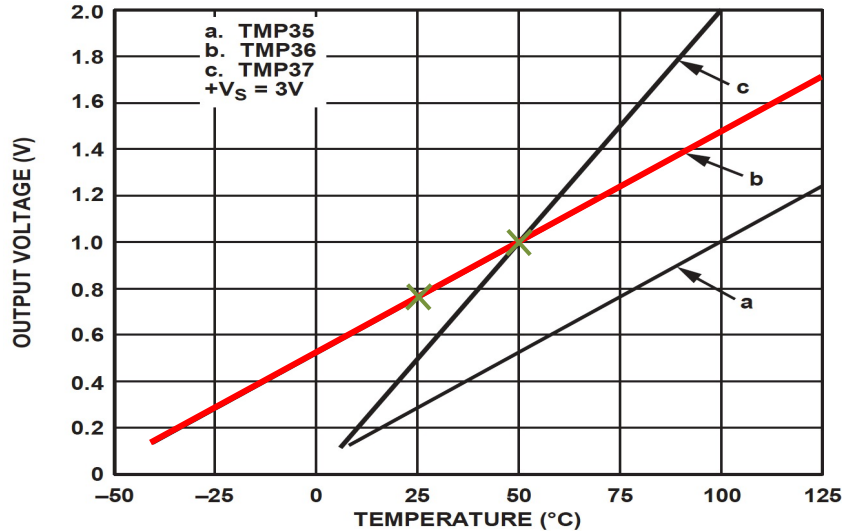
FRONT



BACK

TMP is a small, low-cost temperature sensor and cost about \$1 (you can buy it “everywhere”)

Linear Scaling



This gives:

$$y - 25 = \frac{50 - 25}{1 - 0.75} (x - 0.75)$$

Then we get the following formula:

$$y = 100x - 50$$

Convert from Voltage (V) to degrees Celsius
From the Datasheet we have:

$$(x_1, y_1) = (0.75V, 25^{\circ}C)$$
$$(x_2, y_2) = (1V, 50^{\circ}C)$$

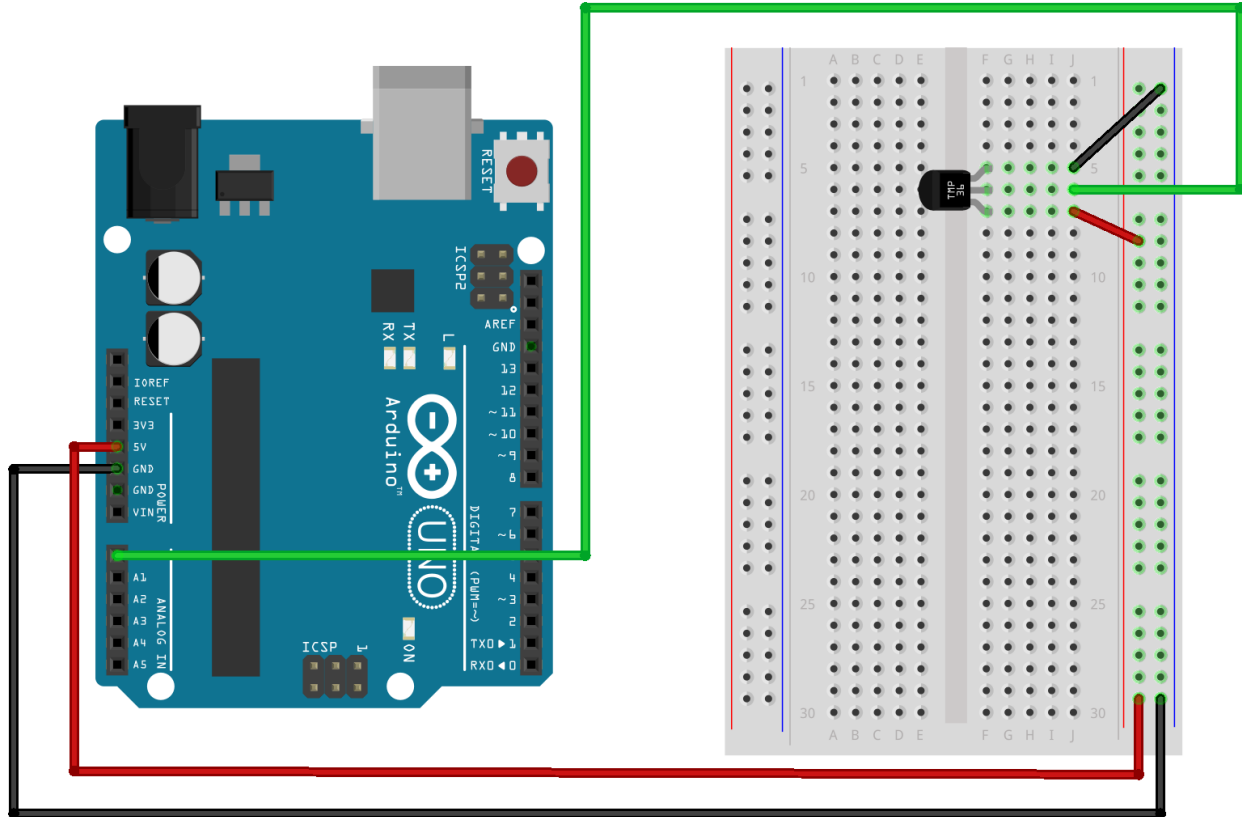
There is a linear relationship between
Voltage and degrees Celsius:

$$y = ax + b$$

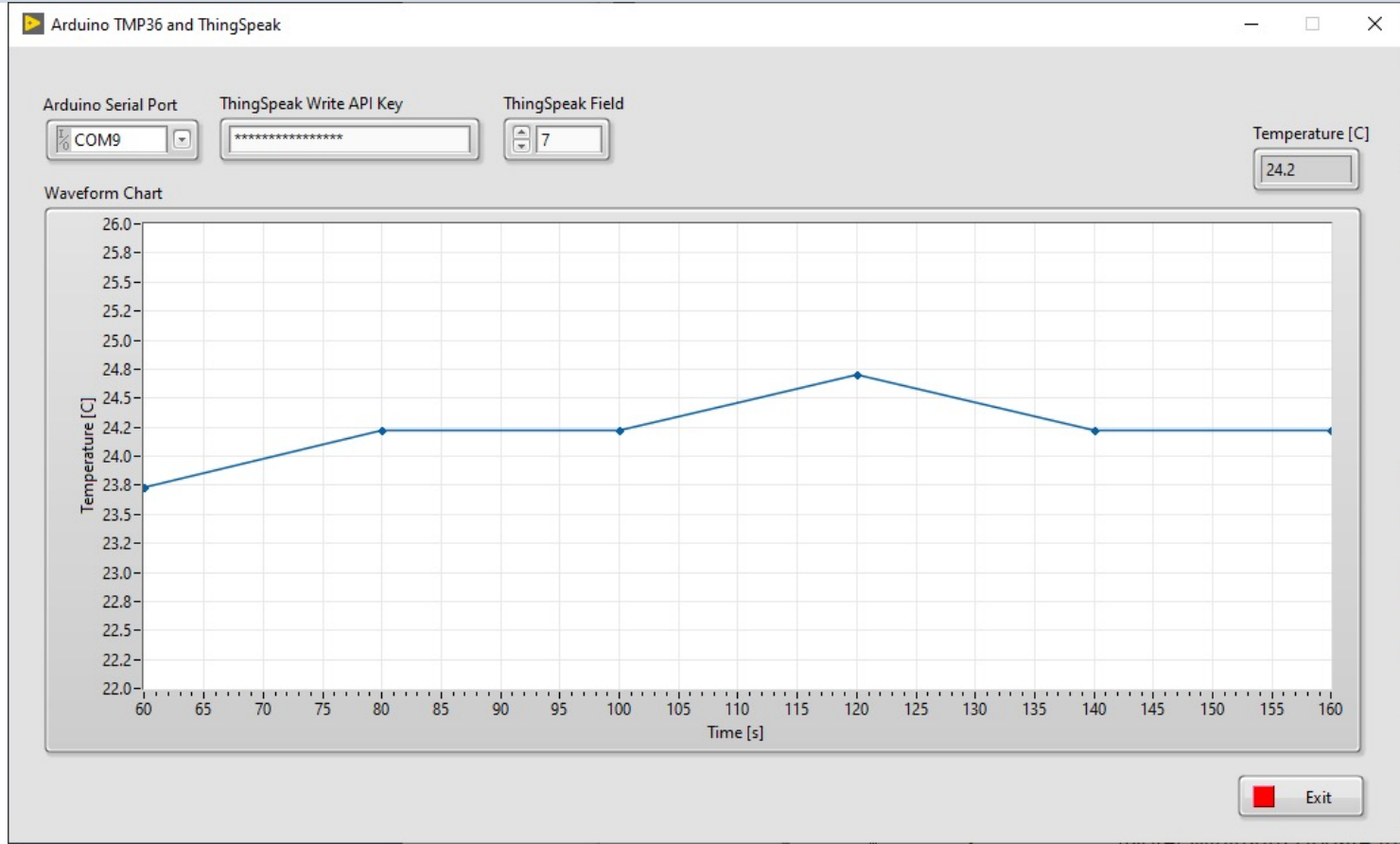
We can find a and b using the following
known formula:

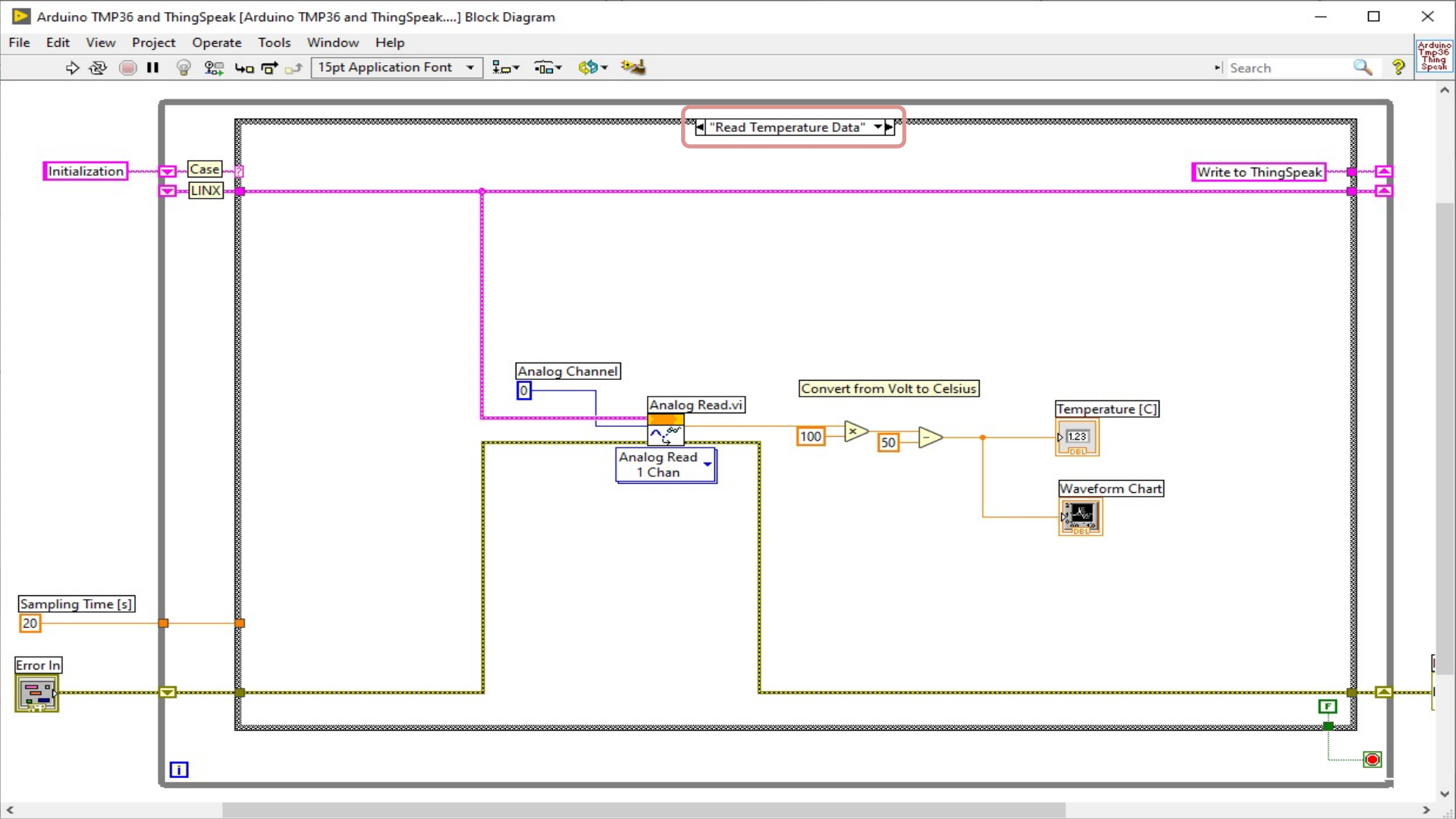
$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

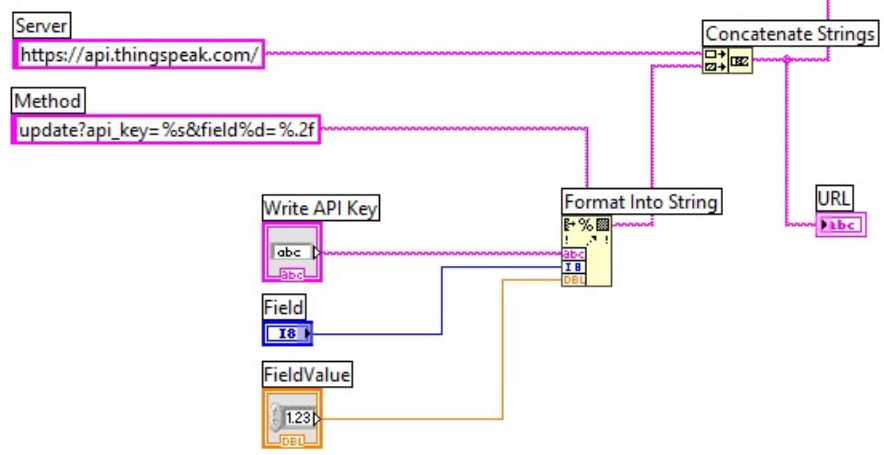
Wiring



LabVIEW







Write API Key

Field FieldValue

URL

Error In
 status code
 source

Error Out
 status code
 source

ThingSpeak



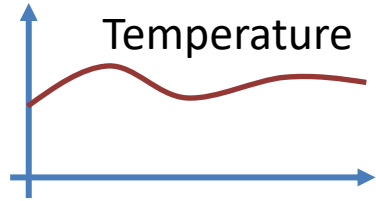
We see that the Temperature Data has been successfully written to ThingSpeak



Summary

- We have successfully logged **Temperature** Data to the **ThingSpeak** Cloud Service using an **Arduino UNO** device.
- The Programming Environment has been **LabVIEW** and the **LabVIEW LINX** Toolkit
- The Temperature Sensor was a **TMP36** Temperature Sensor

Final System

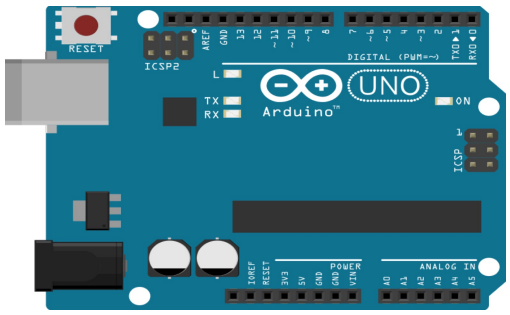


PC



USB cable Type A-B

Arduino UNO



Sensors



TMP36
Temperature Sensor

Hans-Petter Halvorsen

University of South-Eastern Norway

www.usn.no

E-mail: hans.p.halvorsen@usn.no

Web: <https://www.halvorsen.blog>

