Hochschule Konstanz
Department of Computer Science

Lab 1: Arduino

Objective: the main objective of this exercise is to understand the work with the Arduino IDE and how the use the Proteus software. The tasks that will be worked in this example will be implementing a Buzzer, making a LED blink and comnining the LED, Buzzer and a button.

The report must include **ALL** points mentioned in the exercises' descriptions.
Format for the report name: "Lab_2_*surname1_surname2*.pdf"

1   Installation and getting started

1.1 Arduino

Download the Arduino IDE from the official webpage of Arduino and read the getting started manual.

https://www.arduino.cc/en/Guide/Introduction
https://www.arduino.cc/en/Guide/HomePage
Also check the References https://www.arduino.cc/reference/en/

1.2 Proteus

Please use the VPN of the university while downloading, installing and using the program
Please download the Proteus Software from the following link:
   http://downloads.labcenter.co.uk/prosys89/proteus8.9.SP0.exe
You will need the following login details for the download:
   Username: proteus89
   Password: FEL365tops

Installing the software (VPN has to be active)
   Selection: Use a cloud or server based license key
   Server Address: 141.37.158.104:8884

   For the authentication use:
   **Username**: RZ_Login
   Password: WS19-20
   Don't forget to check save login data

   If new updates are necessary update it.

2   Task one: from blinking to communicate

First before we start working you have to start the Proteus program. After this go to File new project and select Project. Afhter this a window opens and you can select new project or from Development Board. Select from development and select the Arduino 328. Finish the wizard at the end.
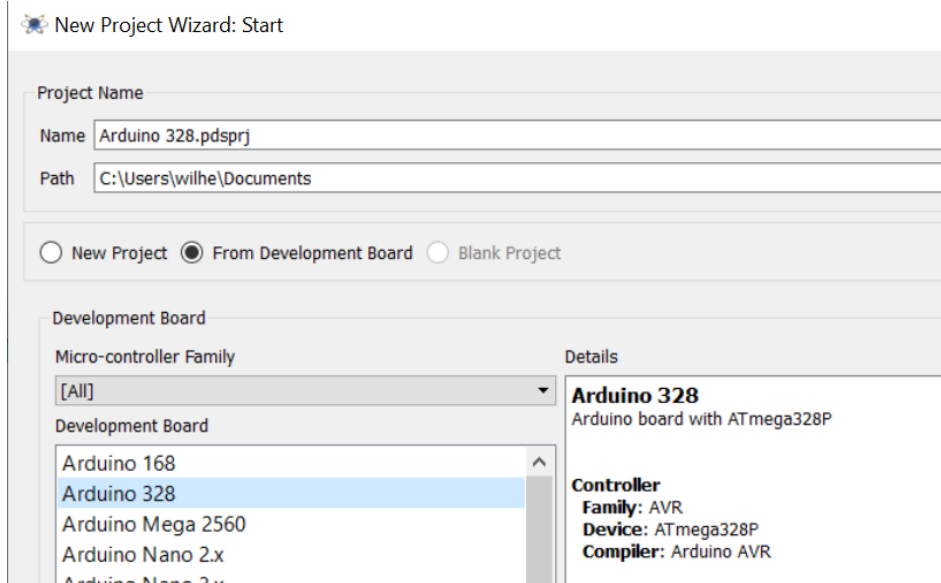
After you finished generating the new project you should have a window like following:
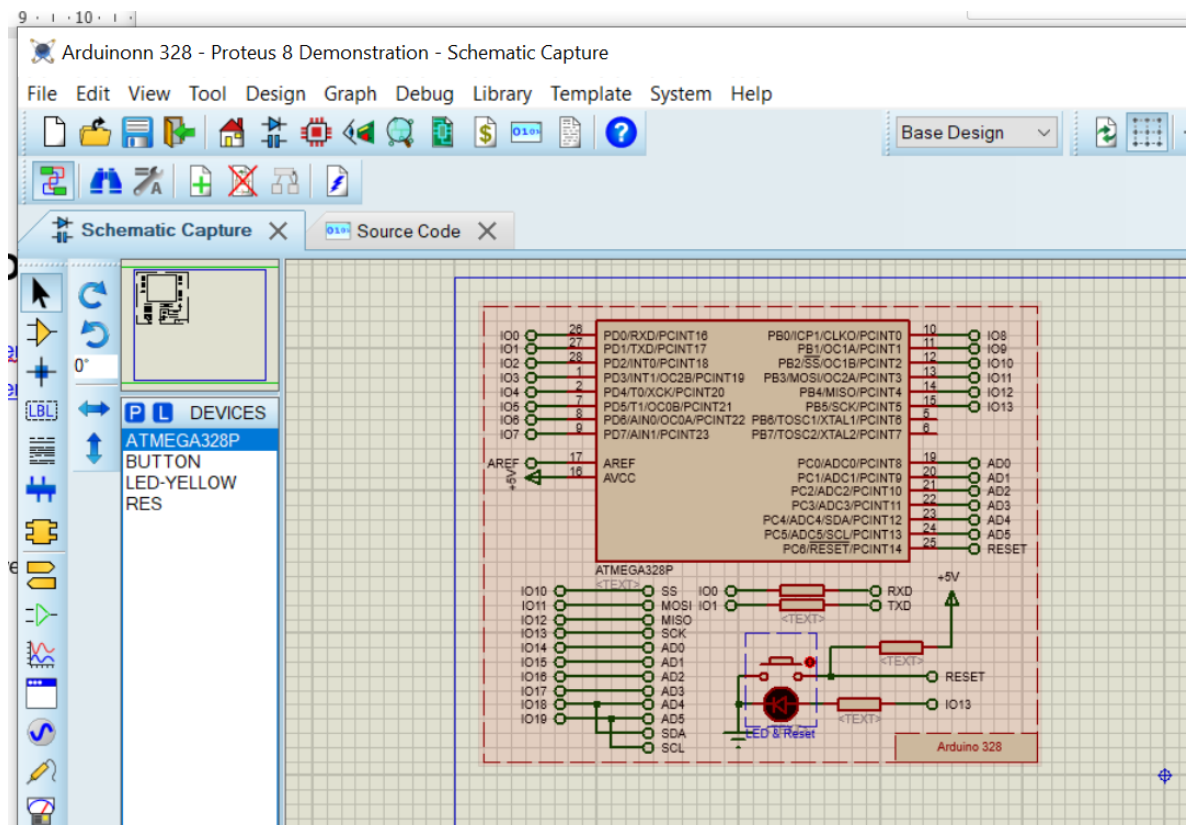
You can also import an Arduino from
https://drive.google.com/file/d/0B3wYaSZct4SyVHBFbVBaYU5ESTg/view
and follow the instructions in the .rar file.

After an Arduino is added (thought creat new project and use the boot loader oder using the library and adding the ardino) we need a button and a LED.
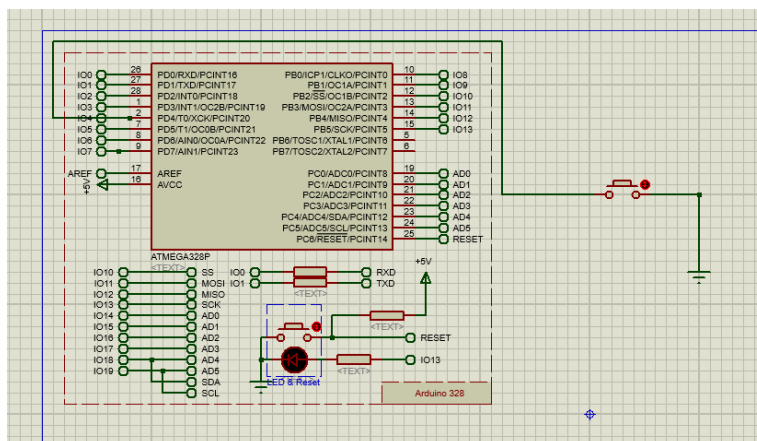
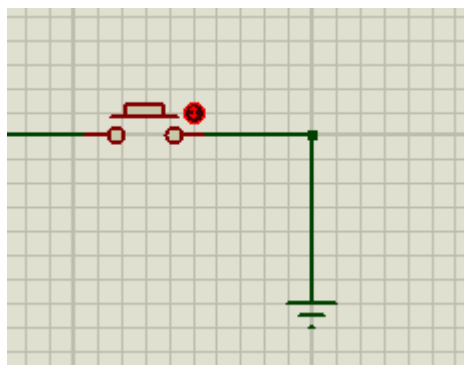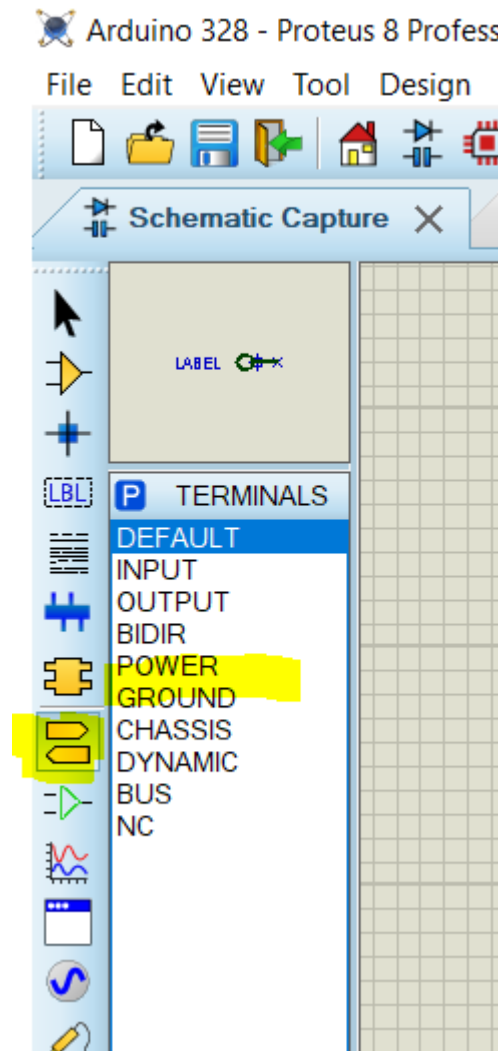Select the component mode and then the pic device.
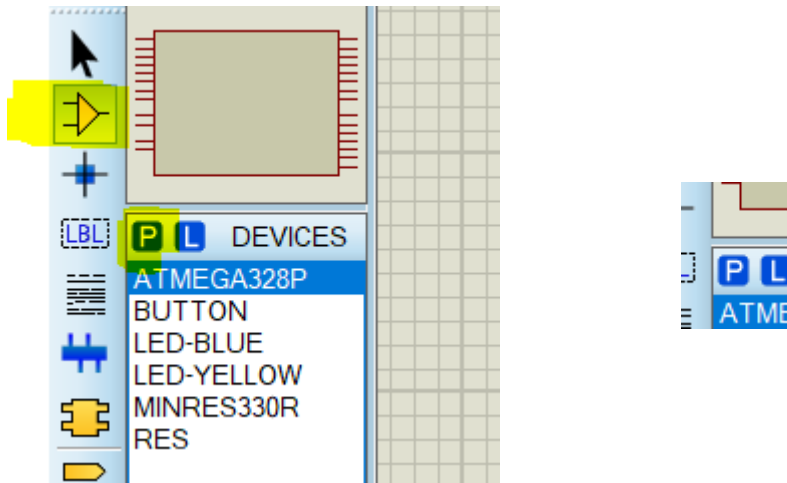
Select in the list (the Arduino) the button by typing in as a keeword and the selecting it.
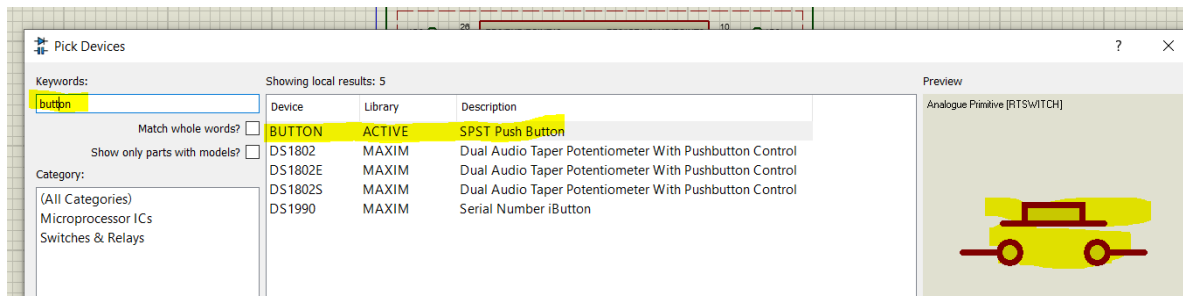
Click in the canvas and connect the two components with the pencil like shown in the following figure.

So that energy can flow we need a ground. This can be added like in the following picture.

Connect the wire to pin 4 (IO4). We still missing following components. Please add resistor (minres330R) and add the LED so it can turn of an on. Connect these to pin 7 (PD7) and the free pin of the switch.

Next step is, code your program in Arduino IDE and export the HEX files where yt under the vunktion
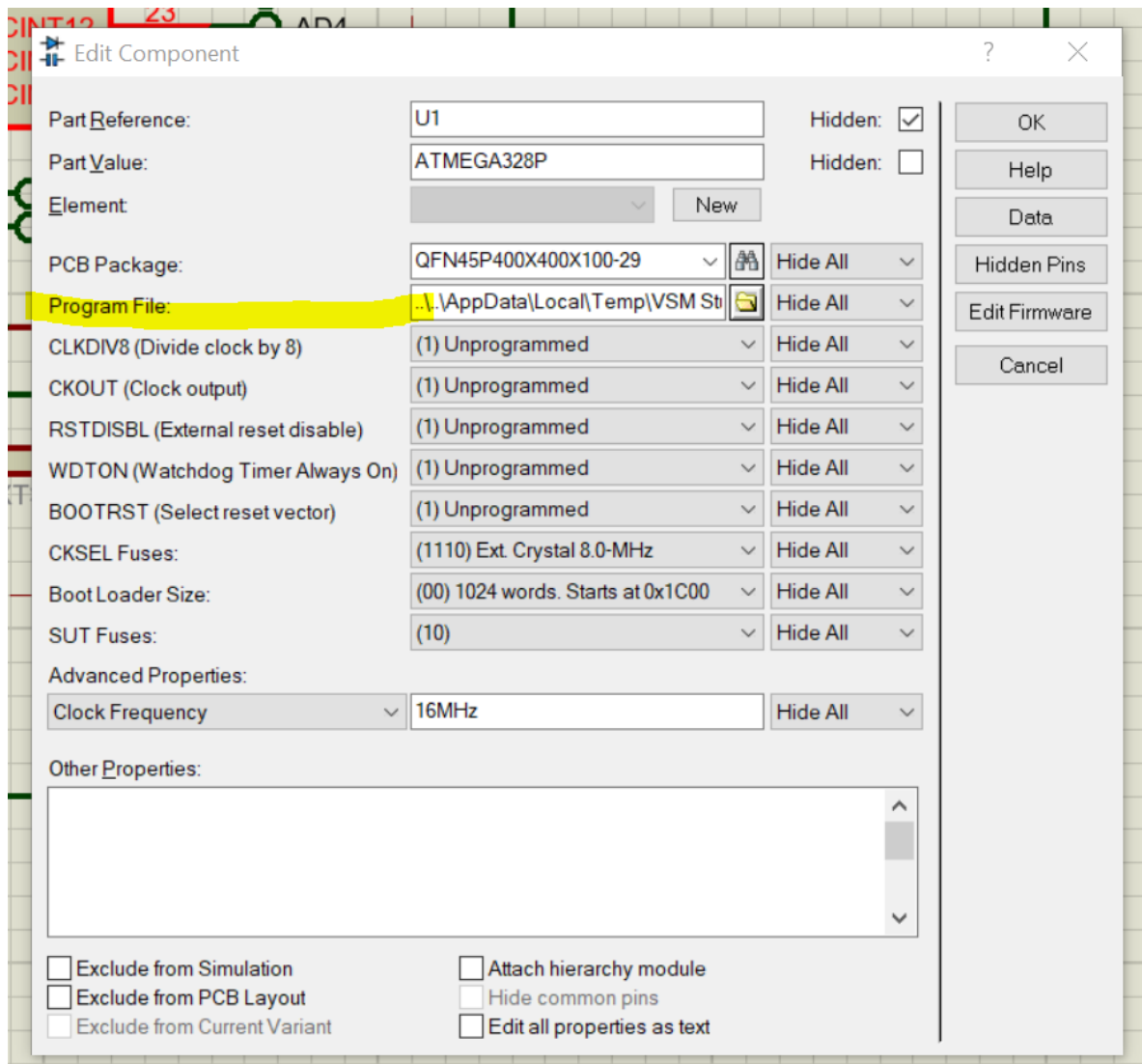
Your code could look like this

After finishing the coding save it and export the hex file. These are saved on the same sport where the project is. You have to go sketch and forth option (export hex). Afther this you can include the hex file in you proteus component. Open the properties of the computing modulo. And select program file.

Start the program on your simulated hardware with.

2.1 Press the button that you added bevor in the schematics. What happened?

2.2 Implement a Blink

Make an LED Blink and Fade. What is the different between the two ways to realize it? Implement the hardware in proeus also and run it.

Describe how it works and what is happening?

Hier some help https://www.arduino.cc/en/Tutorial/Blink or
https://www.arduino.cc/en/Tutorial/BlinkWithoutDelay

2.3 Buzzer

Implement a busser. You can use the example from Arduino
(https://www.arduino.cc/en/Tutorial/toneMelody

)

Explain how it happens and why.

2.4 Merge previous ideas.

Create an idea and implement it Describe your consent and your ideas how to integrate all the previous concepts.

3 Task one: work with a matrix

Please prepper both parts and answer all questions

3.1 First Task to be done

Given the Hardware (Arduino + LED Matrix 16X8 LED) do a counter and a small application. Read the documentation of the module and apply.

3.2 Second Task to be done

Count with the LED from 0 to 128. As Tipp use the function "matrix.drawPixel(X, Y, COLOR)"

How does this function work?

3.3 Second Task to be done

Draw easy Bitmap on the LED Matrix. As Tipp use the function "matrix.drawBitmap(0, 8, om_bmp, 8, 8, HT16K33_BLINK_CMD);"

How does this function work? What else is nessesary?

3.4 Third Task to be done

Print some Text in the LED Matrix. As Tipp use "matrix.print("Hello");" and "matrix.setCursor(x,0);"

How does this work?

3.5 Third Task to be done

Document and explain all functions and how does the Board work.

4   LED Matrix as Terminal Output

Combine the knowledge of the two previous Tasks and write a LED-Banner that plots the data that is send the Arduino via Terminal.
Describe how your program works.

5   Wire layout for temperature measurement(Arduino)

The task is to connect two Arduinos (Figure 1) together using one of the interfaces (SPI, I2C or Serial) for transceiving control commands, which control an output device.

(Arduino/Genuino)

In the first part of the laboratory we will connect the digital thermometer (DS18B20) and the Arduino

Uno, in order to get data from the digital sensor and to measure the temperature.

You need the following:

- 1 or more digital thermometer (DS18B20)
- 1 Arduino Uno or similar board.
- 1 resistor (4,7K Ω)
- Cables (Vcc = red GND = black)
- 1 Breadboard (grey element in the figure)

Figure 1 shows two different operation modes for the digital thermometer, use the one you prefer.

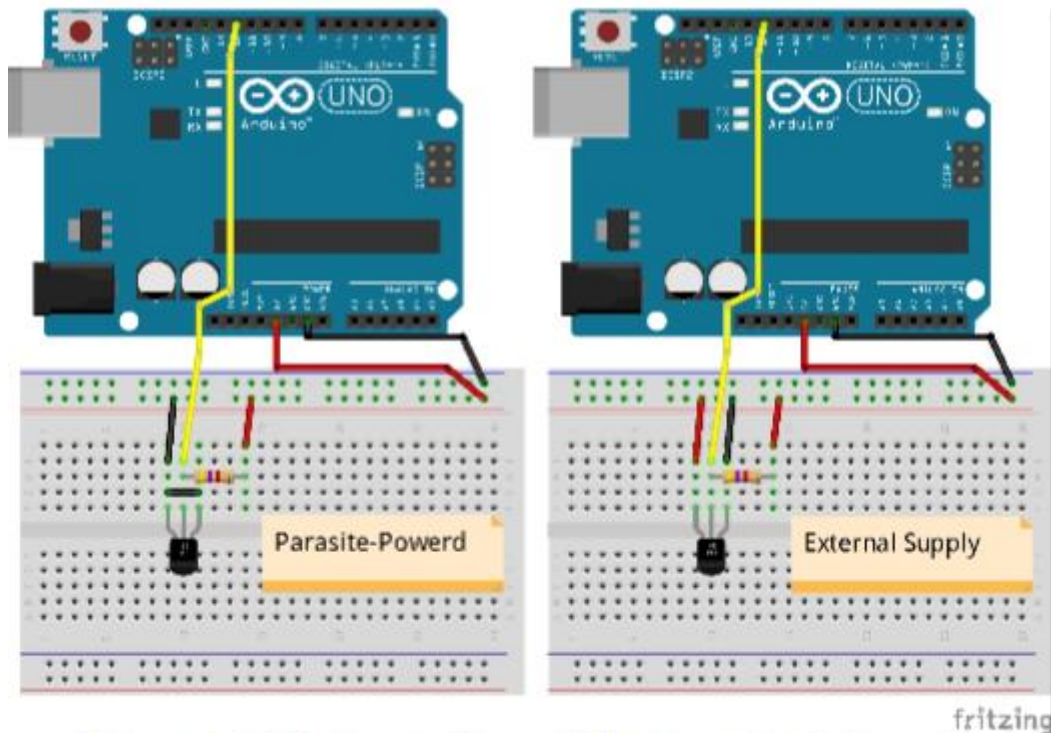Read the datasheet to know the different characteristics of each mode.

Figure 1: HW layout with two different operation modes

5.1 Implementation

The digital thermometer uses a one-wire protocol for communication. Fortunately the Arduino IDE already provides an implementation for the protocol (one-wire library). For this exercise we will use the already existing library. Just download it (http://playground.arduino.cc/Learning/OneWire) and integrated it into the Arduino IDE.

5.2 : Temperature reading

Using the Arduino implement get the data from sensor and plotted at the Serial console.

5.3 : LED scale

Expand the circuit with 2 LED Matix and Print the Temperature.

Helpful TOOLS

Sketching Tool

http://fritzing.org/download/

Arduino IDE

https://www.arduino.cc/en/Main/Software