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Ubiquitous Computing Lab

Degree: Applied Informatics (AIN)
Lecture: Ubiquitous Computing

Laboratory 1: Arduino

Objective: write the text here

1 Basic working with Arduino IO, PWM and Serial

https://www.arduino.cc/en/Guide/Introduction

Look and do this getting started https://www.arduino.cc/en/Guide/HomePage

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

Give a sort overview about the IO of Arduino, what pins are and what kind of pins are there and how to use them.

1.1 First Task to be done

Make an LED Blink and Fade. What is the different between the two ways to realize it? Describe it in few words and give an example. You can use the tutorial.

https://www.arduino.cc/en/Tutorial/Blink

https://www.arduino.cc/en/Tutorial/BlinkWithoutDelay

1.2 Second Task to be done

Make an Buzzer Program. Describe it in few words and give an example how it works. What is needed to make it Buzz.

https://www.arduino.cc/en/Tutorial/toneMelody

1.3 Third Task to be done

Expand the Blink Task with a button or a timer and a Buzzer. Create an Program that uses the knowledge of the last exercises. Describe it in few words how it works.

1.4 Third Task to be done

Communication between different modules: Understand the Serial communication

https://www.arduino.cc/en/Tutorial/DigitalReadSerial

Read and understand what Serial communication is. What other kind of communication possibilities options are there and what are their advantages and disadvantages. Describe at least two additional communication methods and Serial.

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1.5 Third Task to be done

Combine task 1.1 to 1.4. Be creative

Be creative. Create a program that uses LED, Buzzer, timer and serial communication. Describe what is your idea and how do you realize it.

2 LED Matrix

Understand the function of Libraries and how to use them. Do not write to much code.
https://www.arduino.cc/en/Reference/Libraries

2.1 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. Explain how it works and what is necessary. Also describe the parameters.

2.2 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? What are the parameters. How do you make the content fit?

2.3 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 necessary?

2.4 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? What options are avalible? How does the example behave with more longer text? How does it work? What happens whit the memory?

2.5 Third Task to be done

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

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3 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 and what is your concept. Do some sort of planning before you start programing.

4 Wire layout for temperature measurement(Arduino)

Wire layout for temperature measurement

(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.

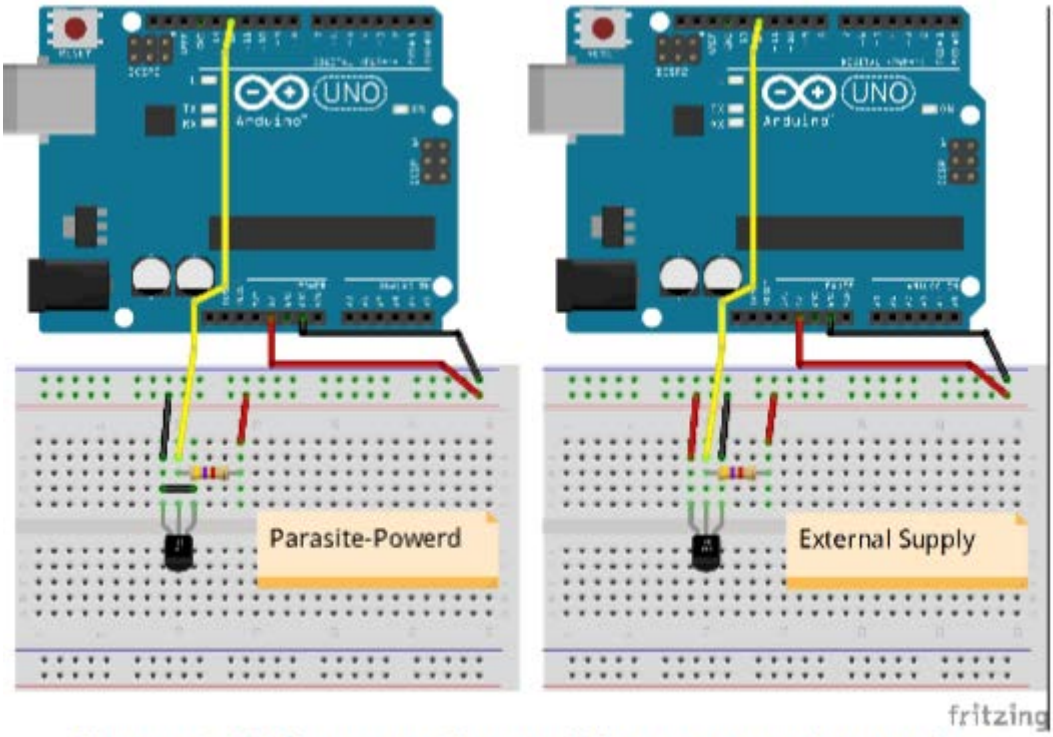

Figure 1: HW layout with two different operation modes

4.1 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.

4.2 : Temperature reading

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

4.3 : LED scale

Expand the circuit with LED Matix and Print the Temperature.

Helpful TOOLS

Sketching Tool

http://fritzing.org/download/

Arduino IDE

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