Documentation for module 2 (day 2)

Three teams will work on the following 3 projects:

- Monitor water depth in a river or channel or reservoir with an ultrasonic water level sensor (MaxBotix)
- Measure air temperature (DS18B20 temperature sensor) and rainfall (tipping-bucket rain gauge)
- Measure soil temperature (DS18B20 temperature sensor) and soil moisture content (Watermark sensors)

Steps to follow during the day:

1. Teams study the available documentation, make a workplan for completing the project, and agree on who is going to work on which subtask
2. Developing and testing code and hardware for project components (sensor reading, LoRa communication, measurement loop, deepsleep, …)
3. Integration of components into (prototype) application and testing
4. Each team presents their application to the entire group

The prototype schematics and MicroPython code for the 3 applications will afterwards be made available to all participants.

Information on the MB7052 ultrasonic water level sensor (Maxbotix):

Data sheet: https://www.maxbotix.com/documents/XL-MaxSonar-WR_Datasheet.pdf

Sonar MB 7052 and Lopy

1.Connect sonar to pycom extension board:

grey= GND

red= 3V3

yellow=p18

2.sonar.py:

this program contains the function get_sonar_dist()

the function averages the voltage from the ADC (Analog to Digital Convertor) 10 times

it converts the voltage to cm according to the datasheet from the MB7052 sonar (+- 3.1 mV/cm)

and returns the measured distance in cm.

3.main.py:

This program import sonar

Calls the function sonar.get_sonar_dist() and prints the distance to screen.

Information on the DS18B20 temperature sensor:

Data sheet (very technical!): https://datasheets.maximintegrated.com/en/ds/DS18B20.pdf

How to read the sensor with the lopy4 and other pycom devices:
https://docs.pycom.io/tutorials/all/owd.html

Information on the Watermark sensor (Irrometer Company):

On how to read a Watermark sensors: http://www.irrometer.com/200ss.html

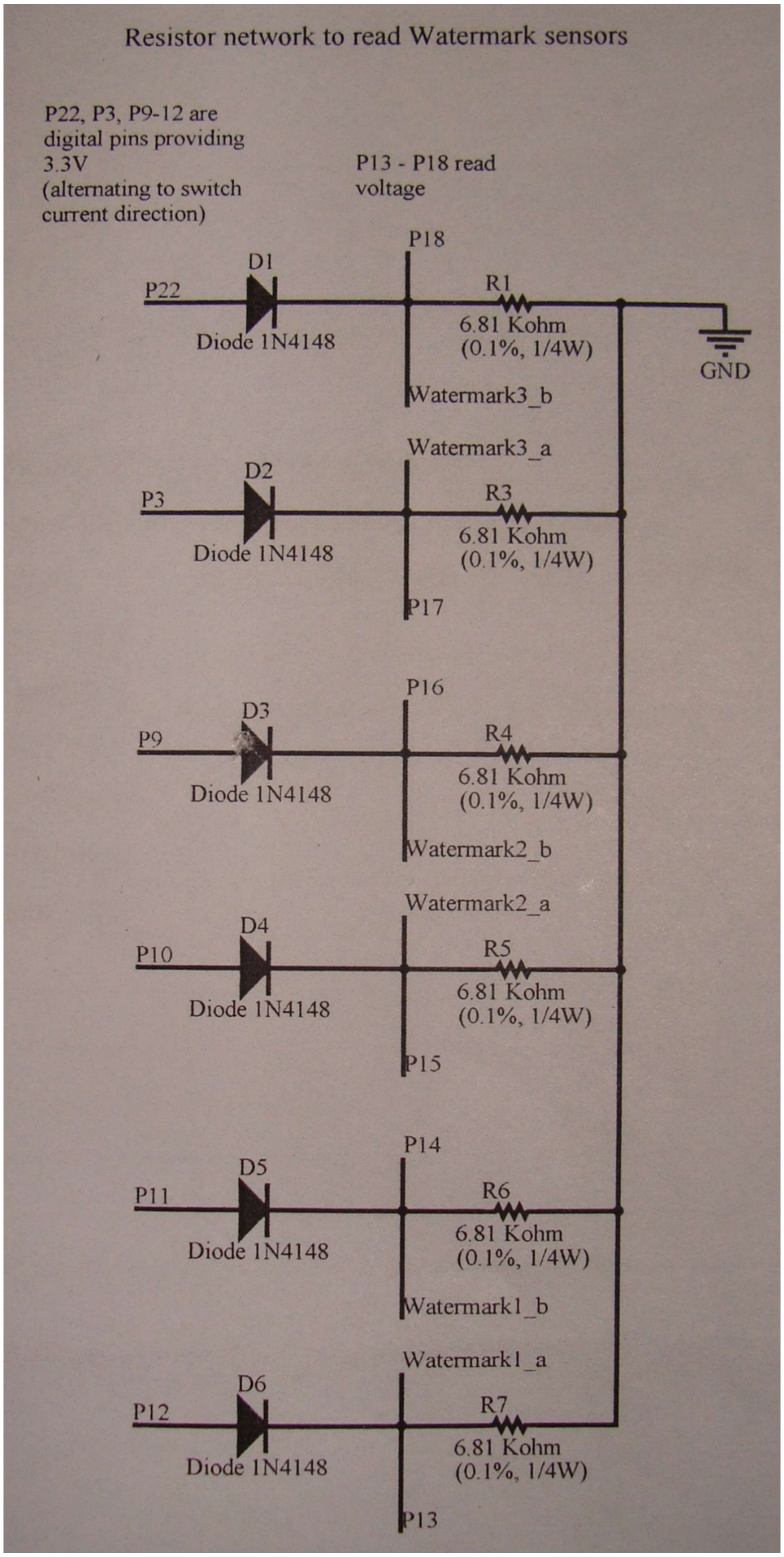
The important message is that to avoid electrochemical effects at the electrodes (due to ion movement under an electrical potential field across the granular matrix between the electrodes) **only very short electrical pulses are used for the measurement, and preferably the polarity is switched with each pulse**.

Here you find the electrical circuit to do that by connecting the Watermark sensor to four (not two) pins with diodes : http://vanderleevineyard.com/vineyard-blog/-the-vinduino-project-3-make-a-low-cost-soil-moisture-sensor-reader . The micropython library that you received assumes you are using such an electrical circuit.

Essentially the Watermark sensor consist of two concentric electrodes that are embedded in a granular matrix (maybe just sand?). The granular matrix is in contact with the surrounding soil: if the soil dries, the granular matrix also dries, and this decreases the electrical conductance of the granular matrix. Hence the resistance between the two electrodes increases as the soil and the sensor dries out. The following video shows somebody opening a Watermark sensor, so you can see the two concentric electrodes: https://www.youtube.com/watch?v=Lpw3SDOGveI

Note (in the video) also that there is a gypsum tablet embedded as well that keeps the salt concentration and hence the electrical conductivity of the pore water in the sensor constant. In this way the sensor is sensitive to the soil moisture status, but not to the soil salinity.

The MicroPython script /Watermark/main.py is for the following electronic circuit:


Resistor network to read Watermark sensors
P22, P3, P9-12 are digital pins providing 3.3V (alternating to switch current direction)
P13 - P18 read voltage
P18
D1
P22
Diode 1N4148
R1
6.81 Kohm (0.1%, 1/4W)
GND
Watermark3_b
Watermark3_a
D2
P3
Diode 1N4148
R3
6.81 Kohm (0.1%, 1/4W)
P17
P16
D3
P9
Diode 1N4148
R4
6.81 Kohm (0.1%, 1/4W)
Watermark2_b
Watermark2_a
D4
P10
Diode 1N4148
R5
6.81 Kohm (0.1%, 1/4W)
P15
P14
D5
P11
Diode 1N4148
R6
6.81 Kohm (0.1%, 1/4W)
Watermark1_b
Watermark1_a
D6
P12
Diode 1N4148
R7
6.81 Kohm (0.1%, 1/4W)
P13