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Sensors and Applications

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**Sheffield
Hallam
University**

***Evaluating suitability of a DS18B20
temperature sensor for use in an accurate
air temperature distribution measurement
network***

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Video brief
joioioioio

Outline

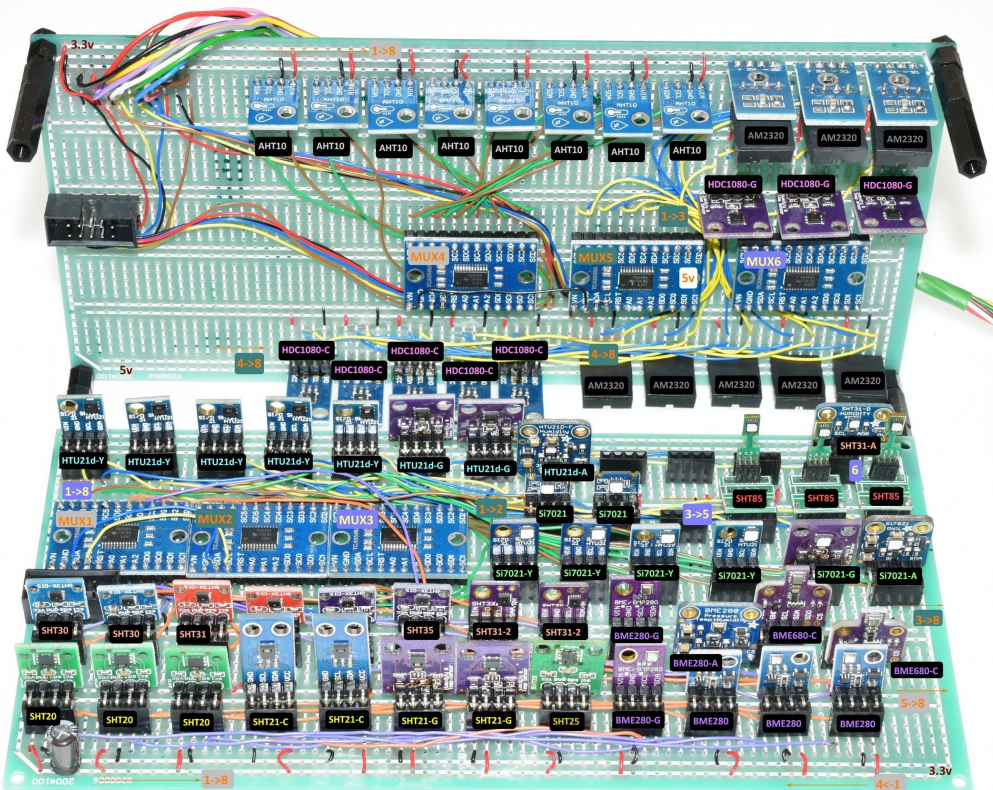
- Why the air temperature measurement network
- Reading disparities from the literature
- Air-gapped Pt100 and DS18B20
- AHT20 and BMP280 soldered to the same board
- Summary and conclusions

Motivation for the research

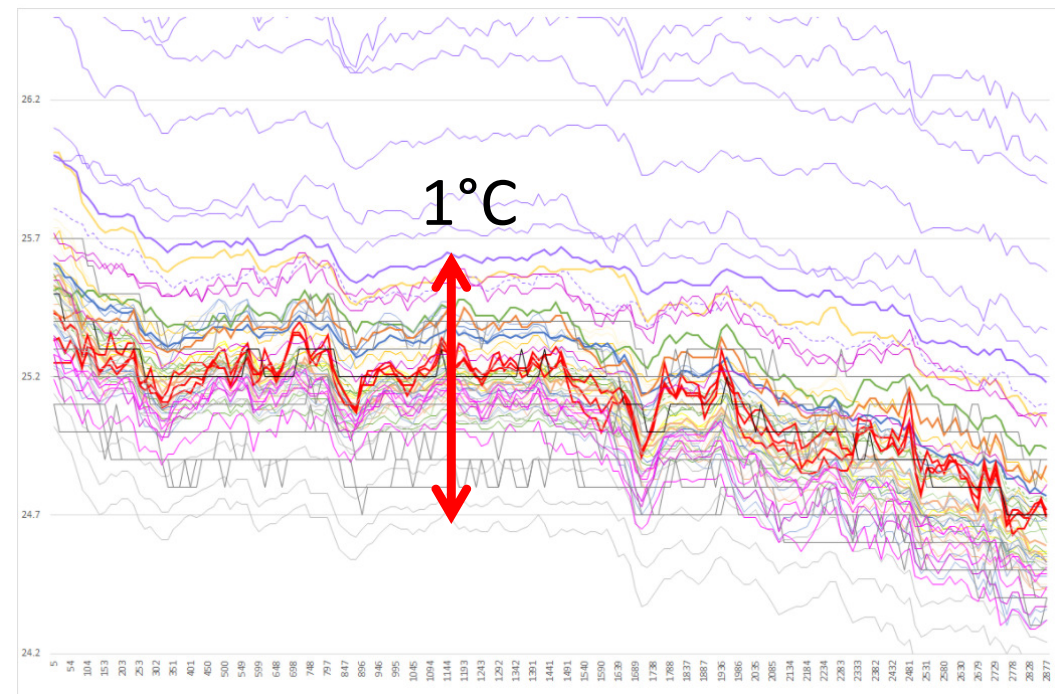
- People mostly use one thermometer for a room
- Examples of networks
 - based on Pt100 sensors to optimise design of a refrigerator
 - commercial thermometers to optimise room ventilation
- We need a air temperature measurement network to verify the operation of the ultrasonic oscillating temperature sensor we are developing

Reliability – scatter (O.Liutyi's data for 68 sensors)

<https://wiki.liutyi.info/display/ARDUINO/Test+11+v5+room+RH60>

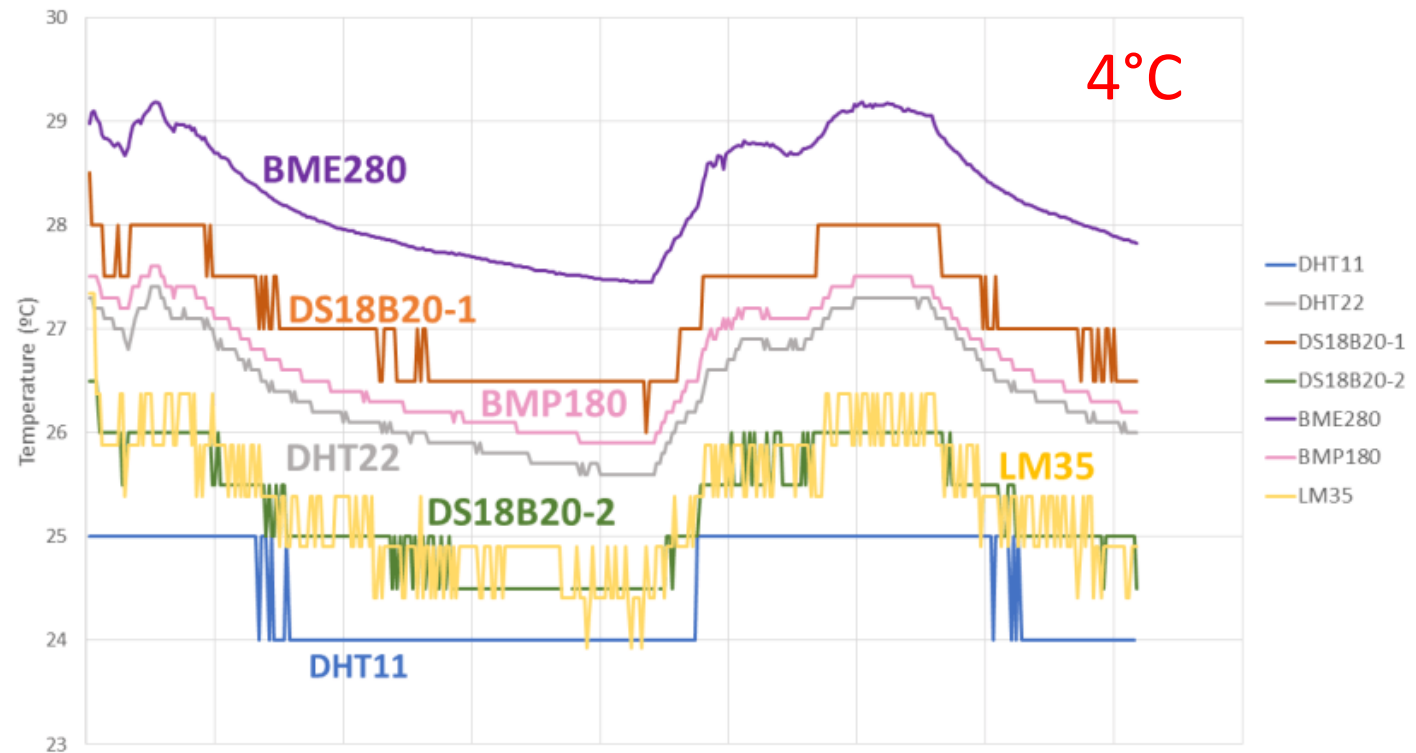
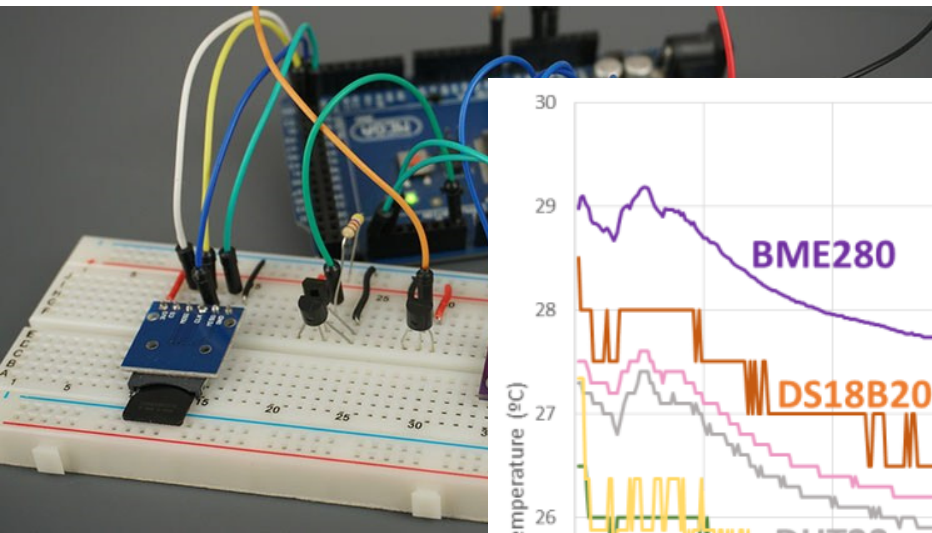


<https://wiki.liutyi.info/display/ARDUINO/v5+Sensors+Board+project>



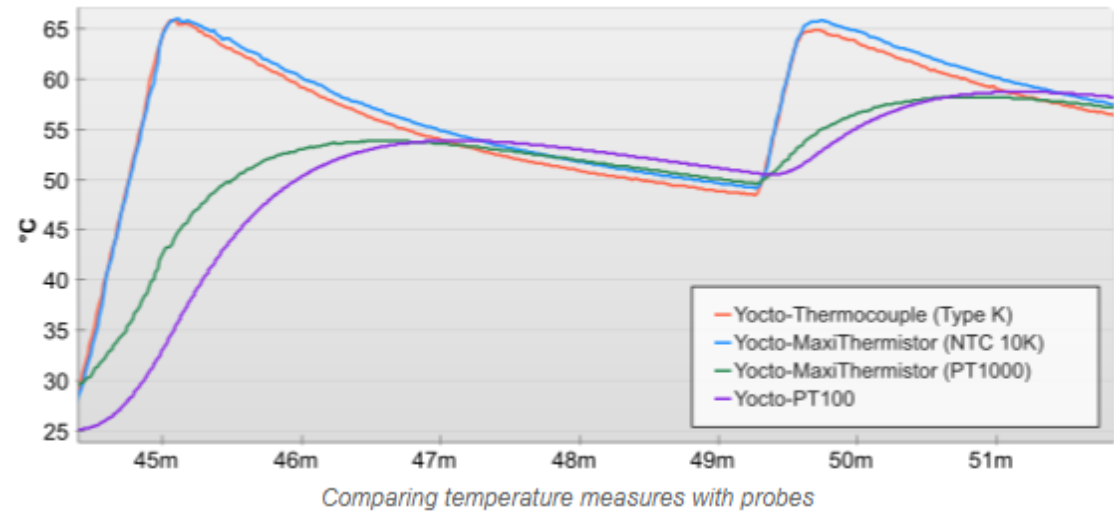
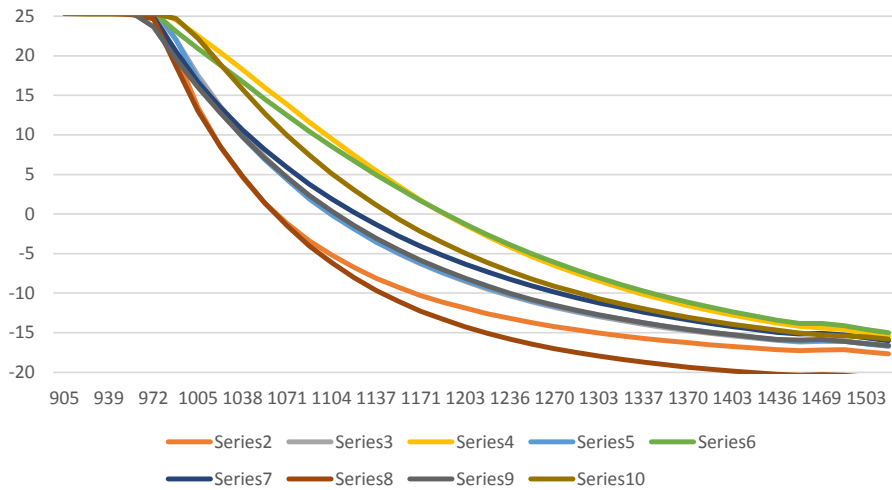
Reliability – scatter (RandomNerd's data 36 h)

<https://randomnerdtutorials.com/dht11-vs-dht22-vs-lm35-vs-ds18b20-vs-bme280-vs-bmp180/>



Reliability – step change of temperature (15°C)

Temperature readings (°C) vs time (s) in the transition region

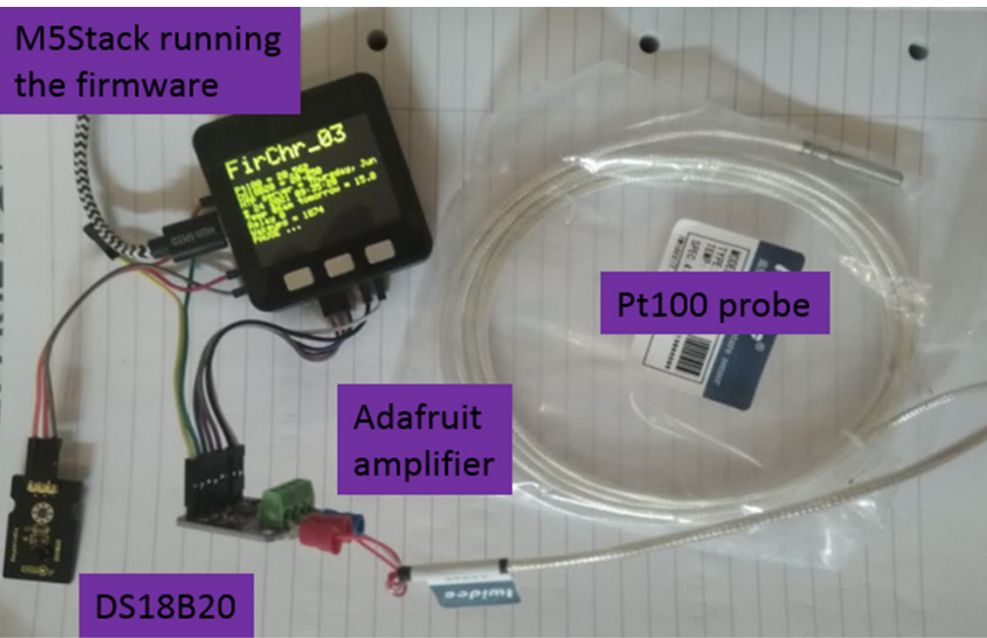


<https://wiki.liutyi.info/display/ARDUINO/Test+10+v5+board+in+Freezer>

<https://www.yoctopuce.com/EN/article/how-to-choose-a-temperature-sensor>

Air-gapped Pt100 and DS18B20 sensors (1)

M5Stack running the firmware



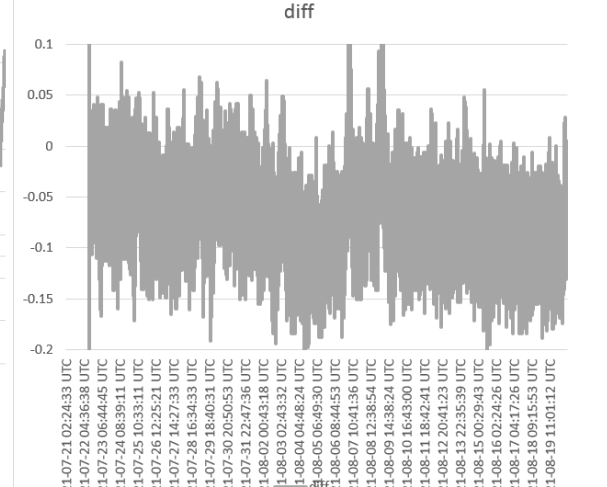
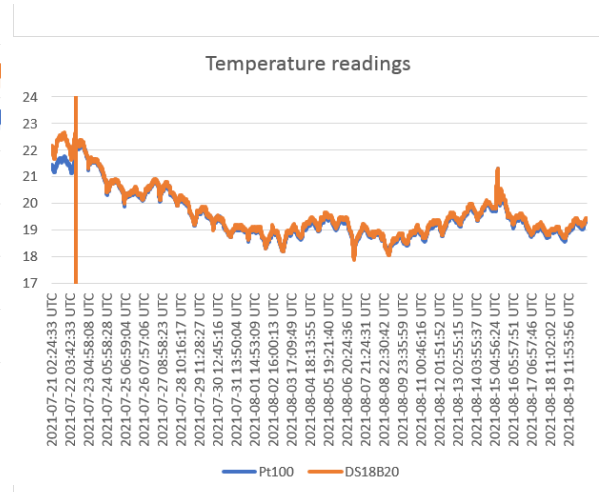
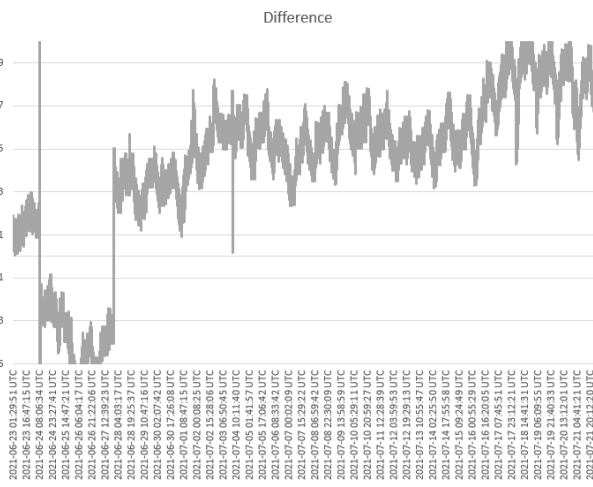
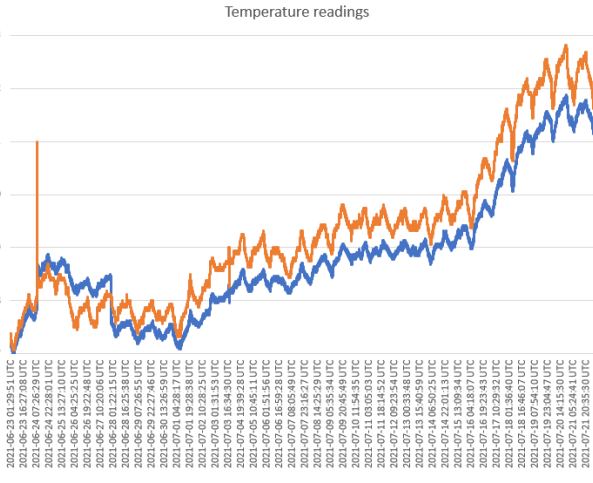
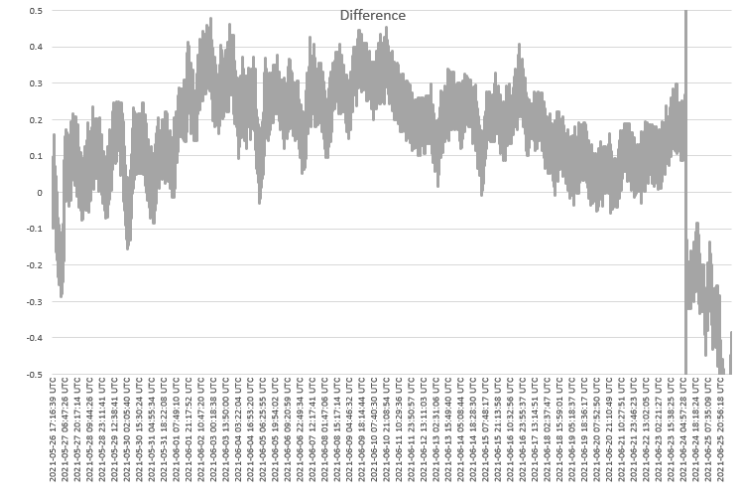
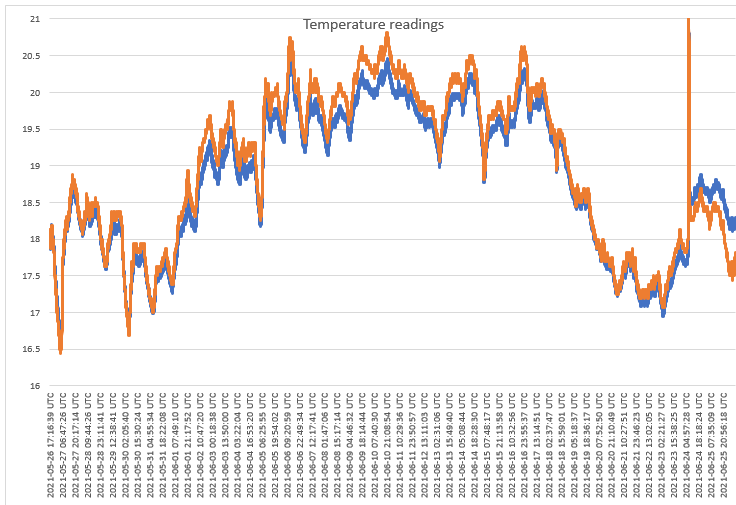
Pt100 probe

Adafruit amplifier

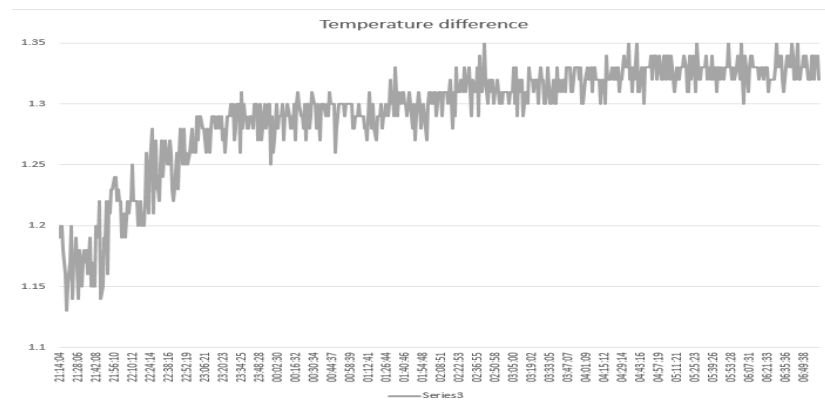
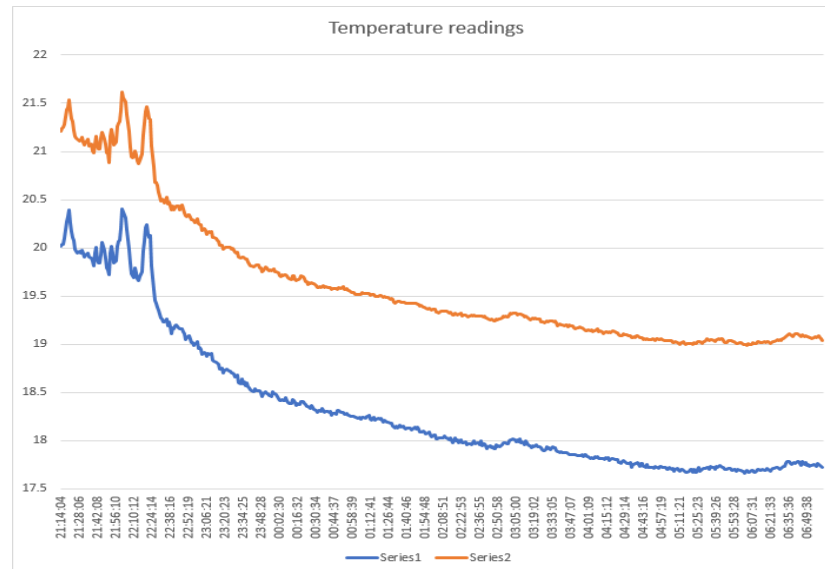
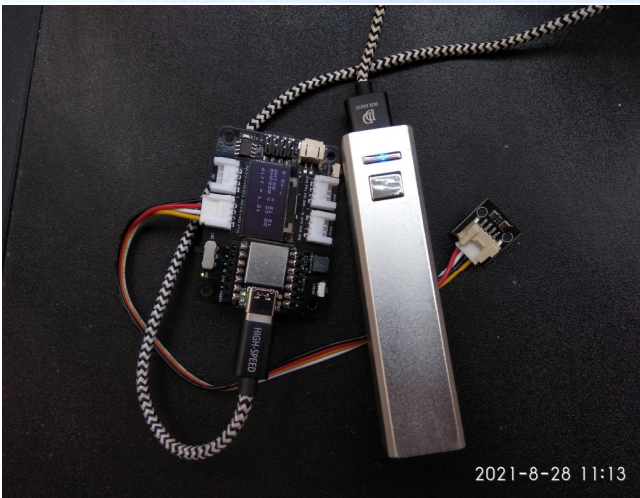
DS18B20



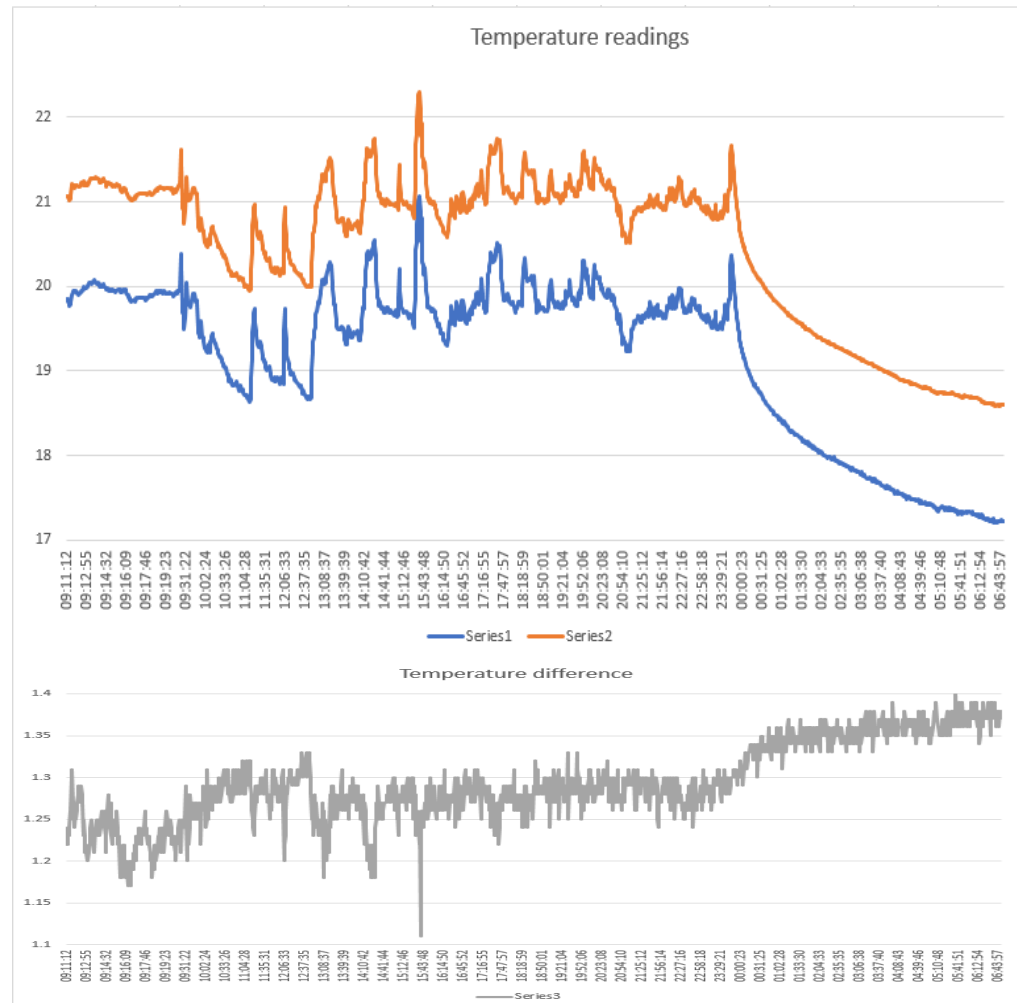
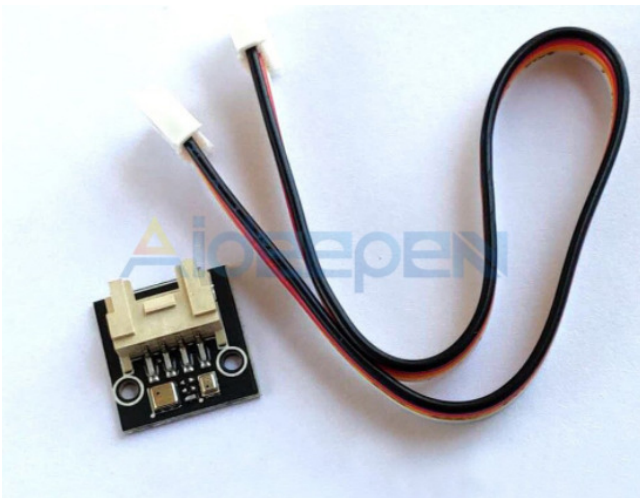
Air-gapped Pt100 and DS18B20 sensors (2)



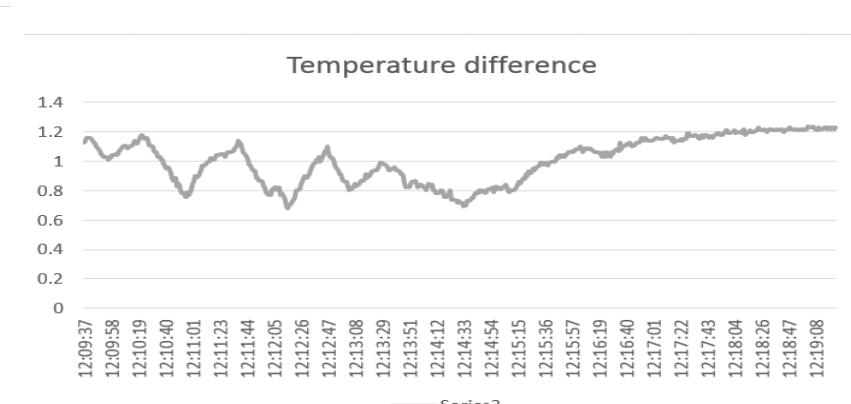
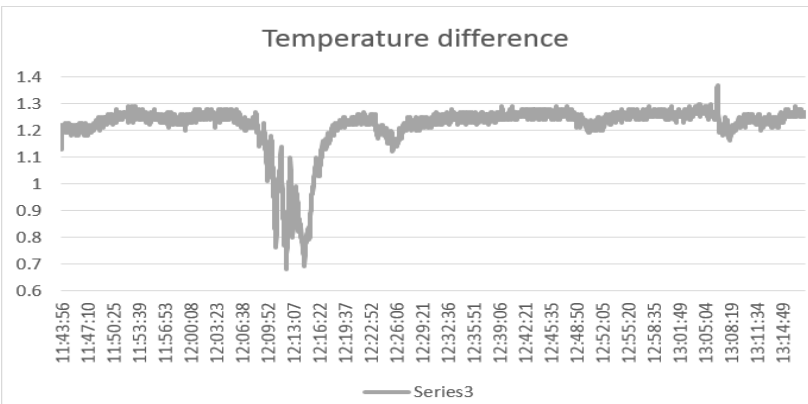
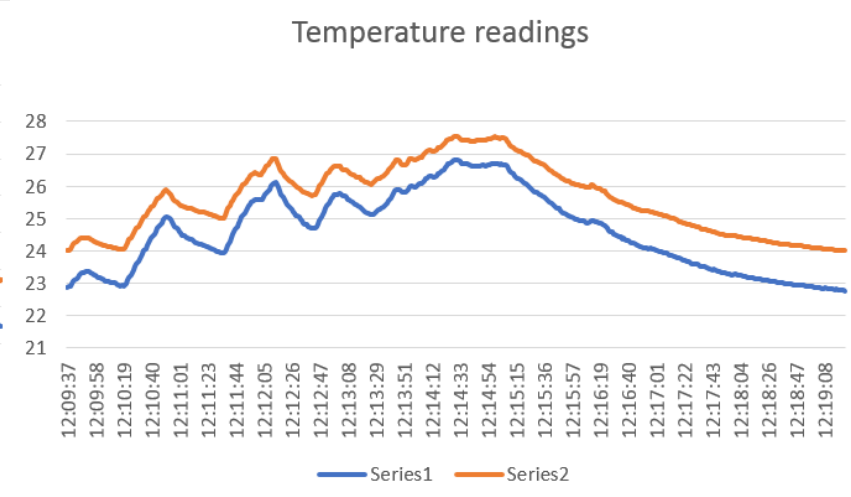
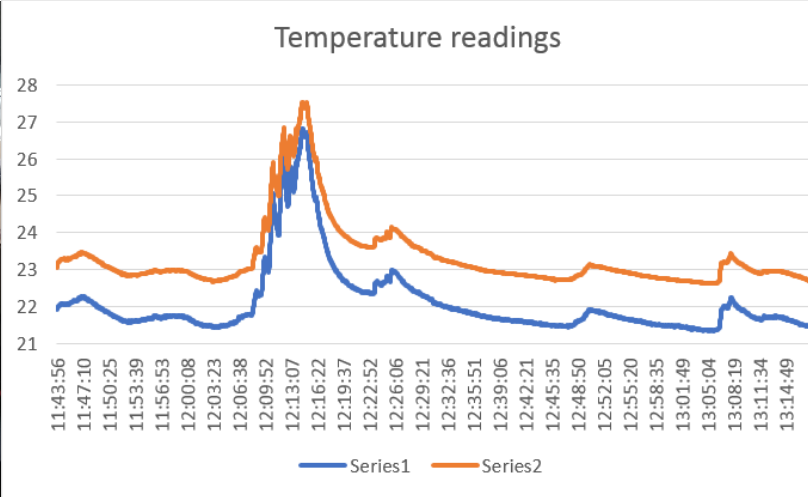
AHT20 and BMP280 soldered to the same board (1)



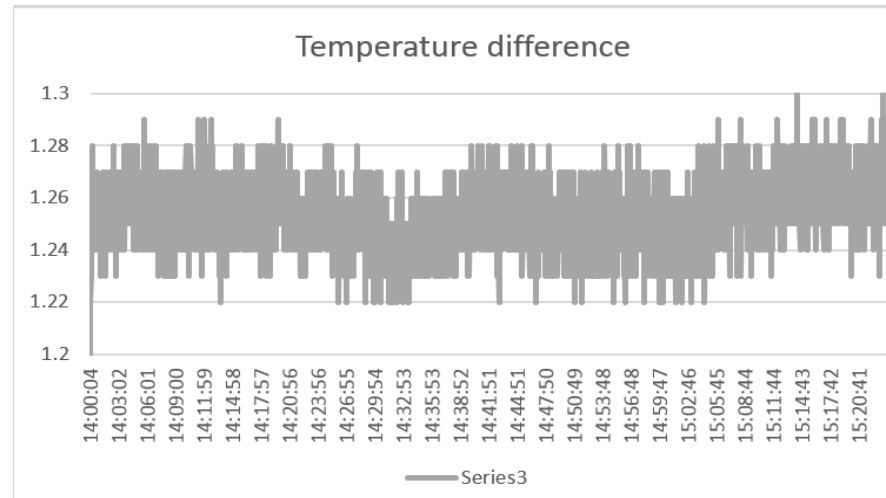
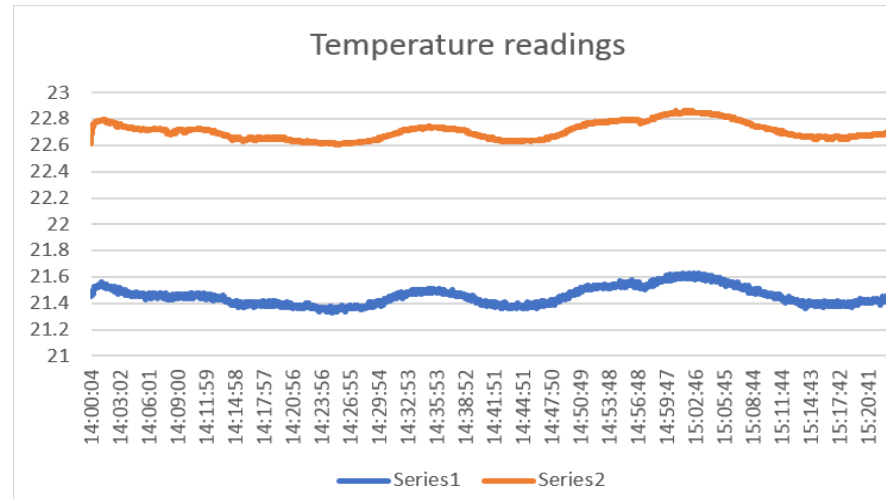
AHT20 and BMP280 soldered to the same board (2)



AHT20 and BMP280 soldered to the same board (3)



AHT20 and BMP280 soldered to the same board (4)



Summary and conclusions

- Substantial differences in sensor readings can be observed if the temperature changes quickly. This occurs due to the differences in the sensors' response times.
- If the air movements are not restricted, even closely placed sensors can report notably different data.
- Absolute accuracy might be tricky to achieve, but relative measurements can be quite consistent if the sensors are placed inside a common enclosure with a limited air volume. Under these conditions, the readings of different sensors might stay much closer than can be expected from the relevant manufacturers' specifications; the biases among sensors, if present, can be eliminated with the subsequent processing.