Chair of Nanoelectronics
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Sensor Nodes Laboratory Presentation

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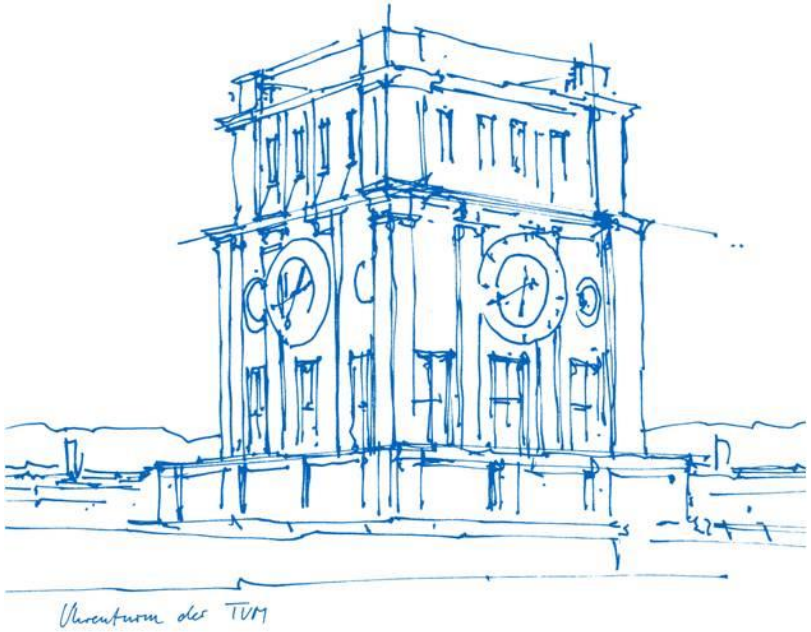
August 28, 2019



Overview

- Introduction
- Block diagram
- Read-out circuit
- Communication
- Data reception
- Scaling-up
- Conclusion

Introduction

Goal: To develop a fully functional prototype of a wireless sensor node by the end of summer semester 2019

Sub-tasks:

- To develop a read-out front-end circuit
- To implement a communication interface between the read-out circuit and wireless communication board
- To encapsulate the data, send it over a server and visualize it on a terminal

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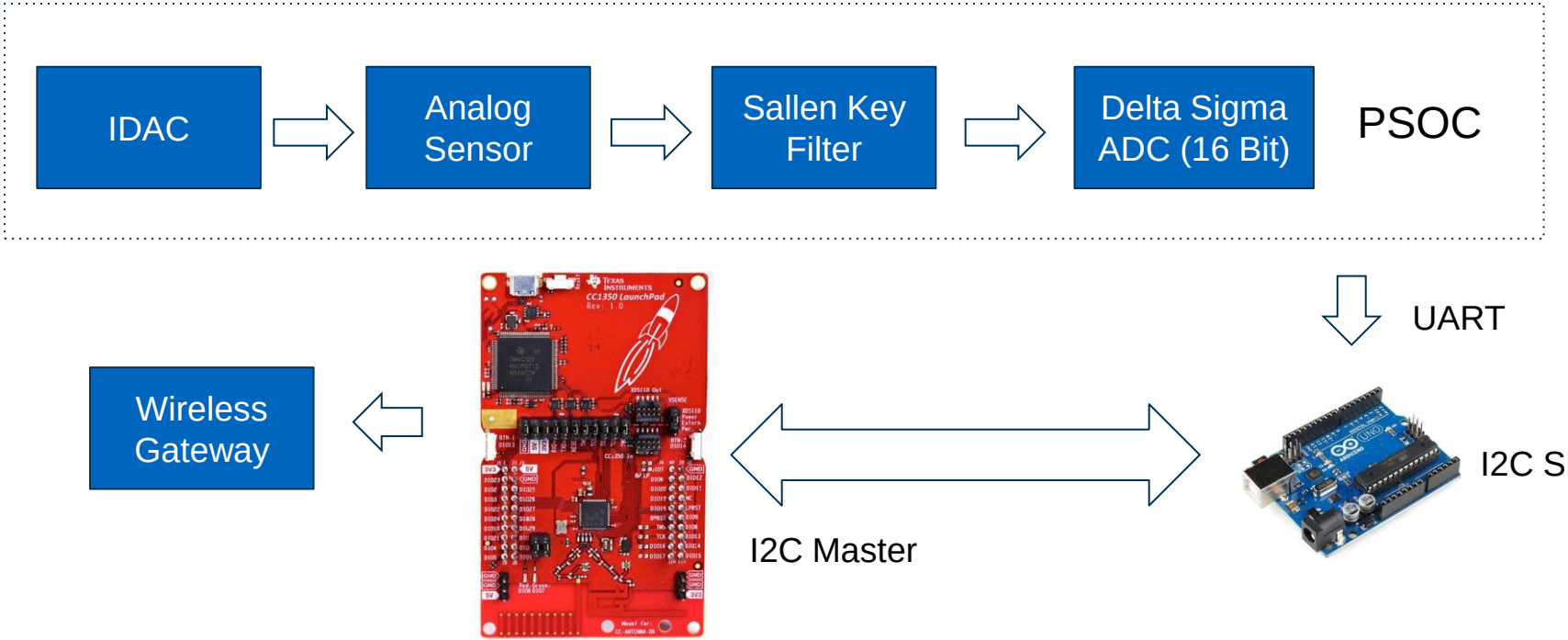
Block Diagram



IDAC - Constant Current Source

-50 < T < 200 °C

Current = 1 mA

R_{RTD} = [803.1, 1758.56] Ω

```
/* Start the IDAC component */
IDAC8_1_Start();

/* Sets the IDAC full scale range to 255uA */
IDAC8_1_SetRange(IDAC8_1_RANGE_2mA);

/* Sets the IDAC value to 1 mA */
IDAC8_1_SetValue(126u);
```

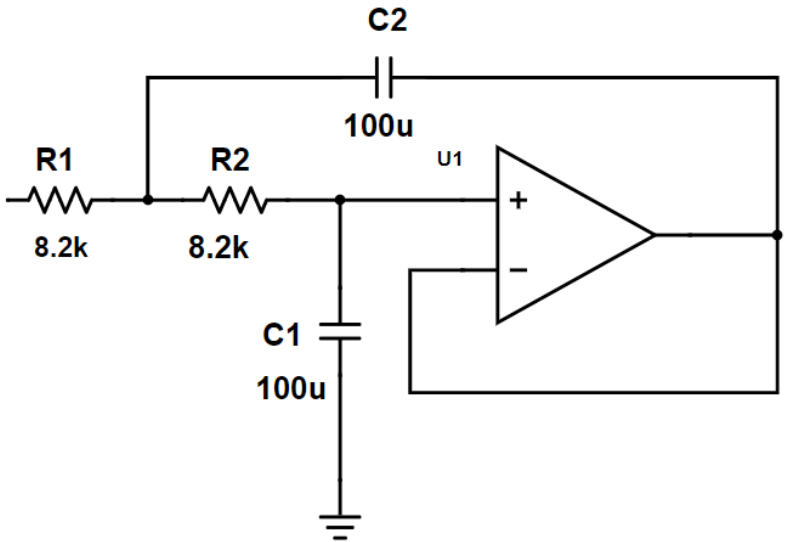
Filter Design

Second Order Sallen Key Low-pass Filter

fc = 0.2 Hz

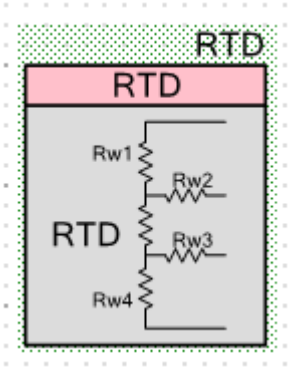
Q = 0.5

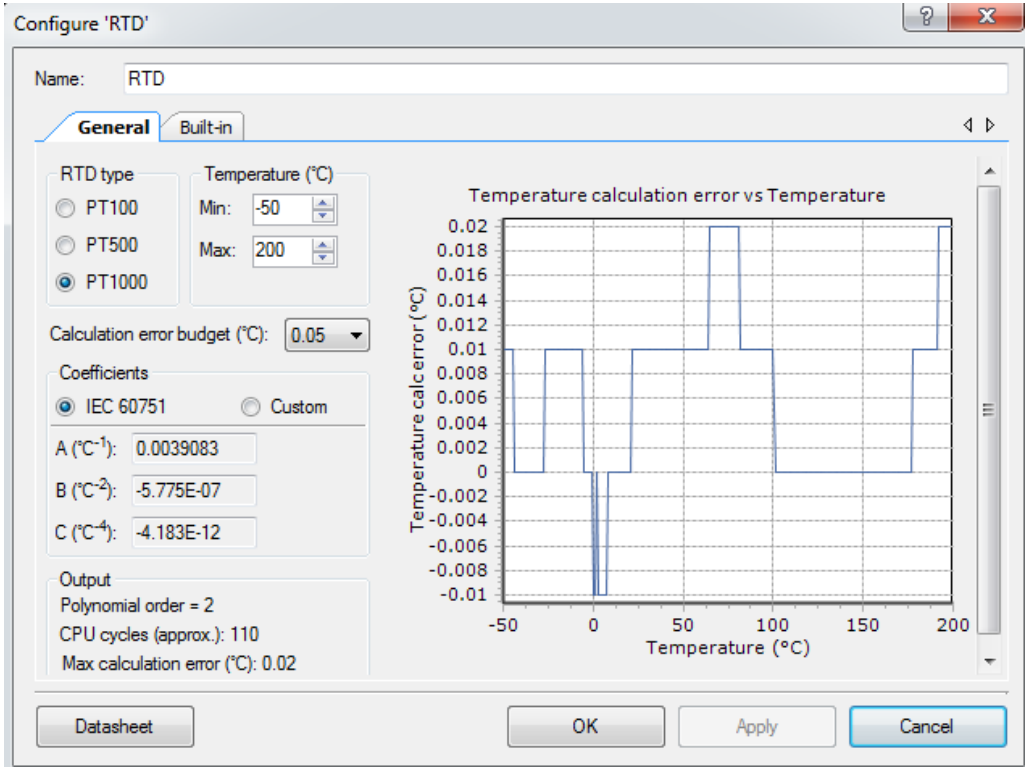
Zeta = 1.0



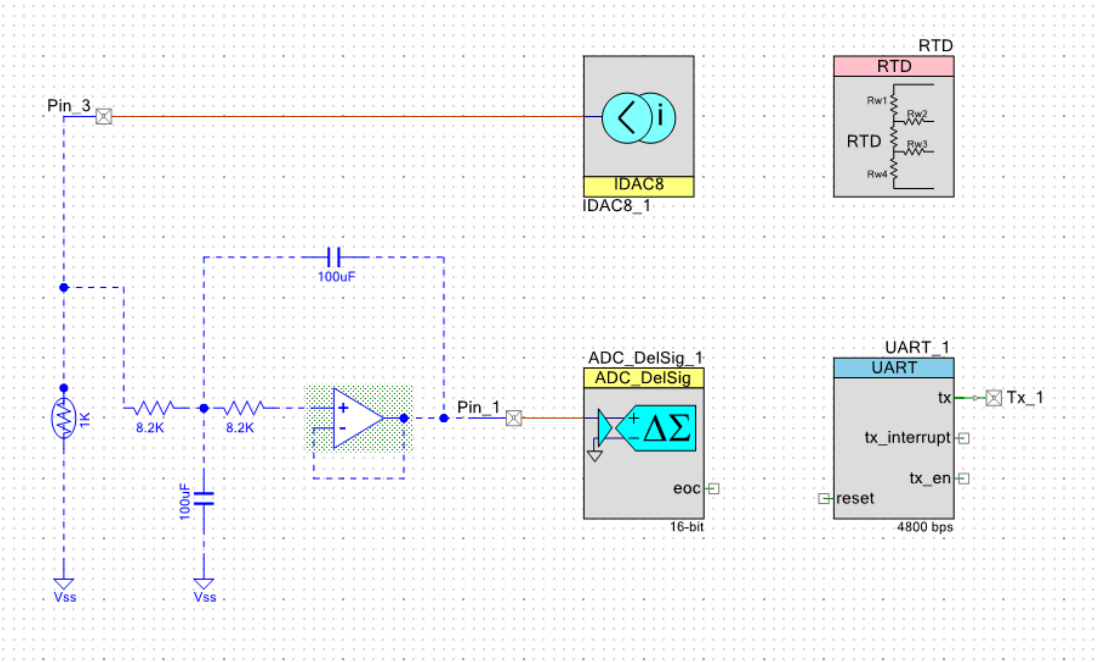
Source: http://sim.okawa-denshi.jp/en/OPstool.php

RTD Block

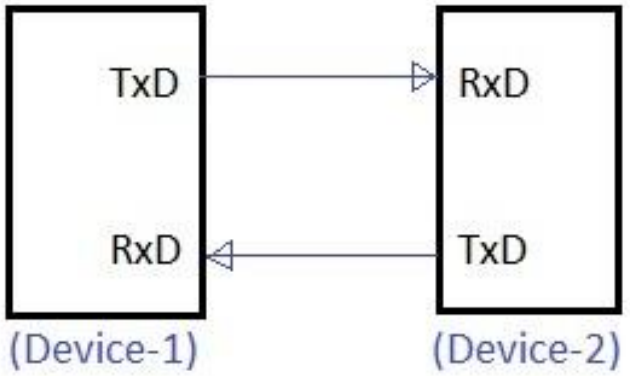

RTD
RTD
Rw1
Rw2
RTD
Rw3
Rw4


Configure 'RTD'
Name: RTD
General
Built-in
RTD type
PT100
PT500
PT1000
Temperature (°C)
Min: -50
Max: 200
Calculation error budget (°C): 0.05
Coefficients
IEC 60751
Custom
A (°C-1): 0.0039083
B (°C-2): -5.775E-07
C (°C-4): -4.183E-12
Output
Polynomial order = 2
CPU cycles (approx.): 110
Max calculation error (°C): 0.02
Temperature calculation error vs Temperature
Temperature calc error (°C)
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
-50
0
50
100
150
200
Temperature (°C)
Datasheet
OK
Apply
Cancel

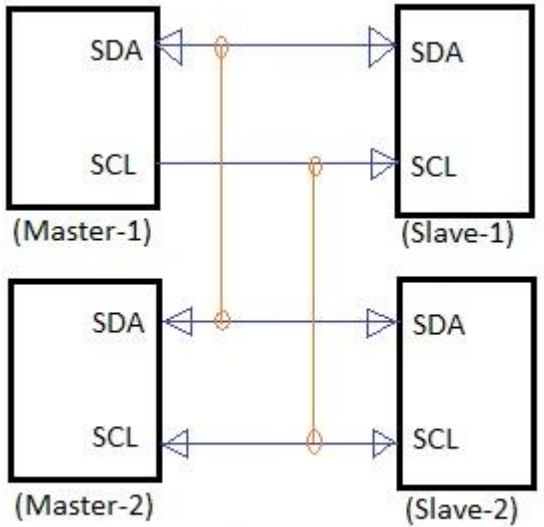
PSoC and Analog Front-End Schematic



UART vs I2C



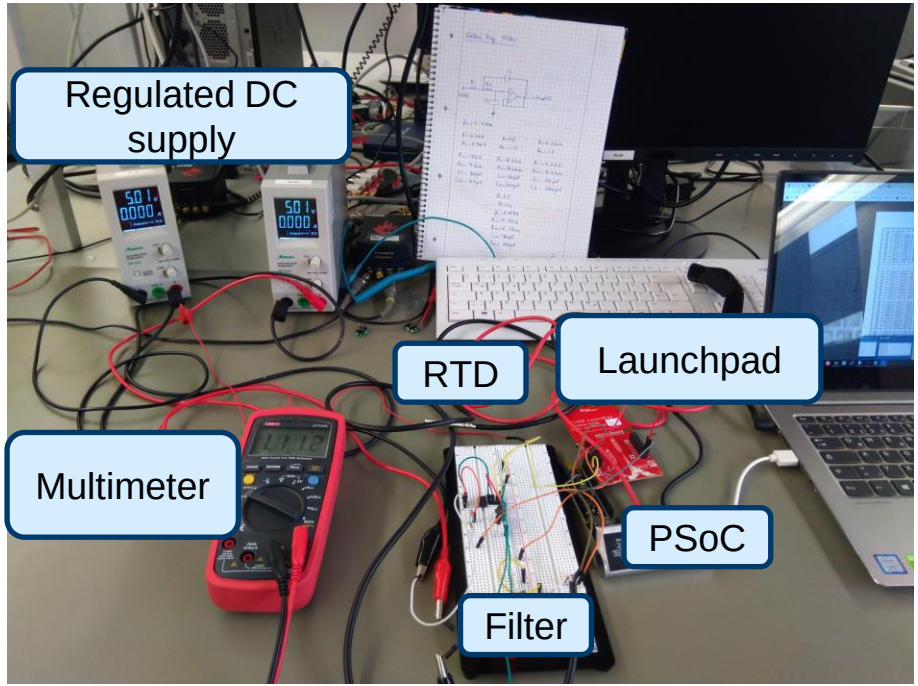
UART Interface Diagram



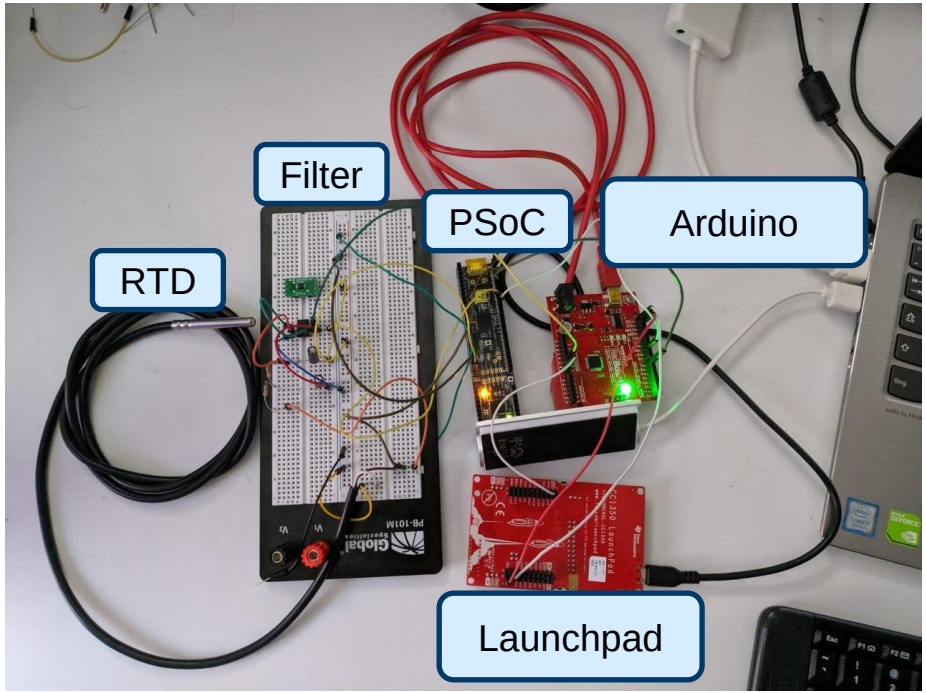
I2C Interface Diagram

Source: https://www.rfwireless-world.com

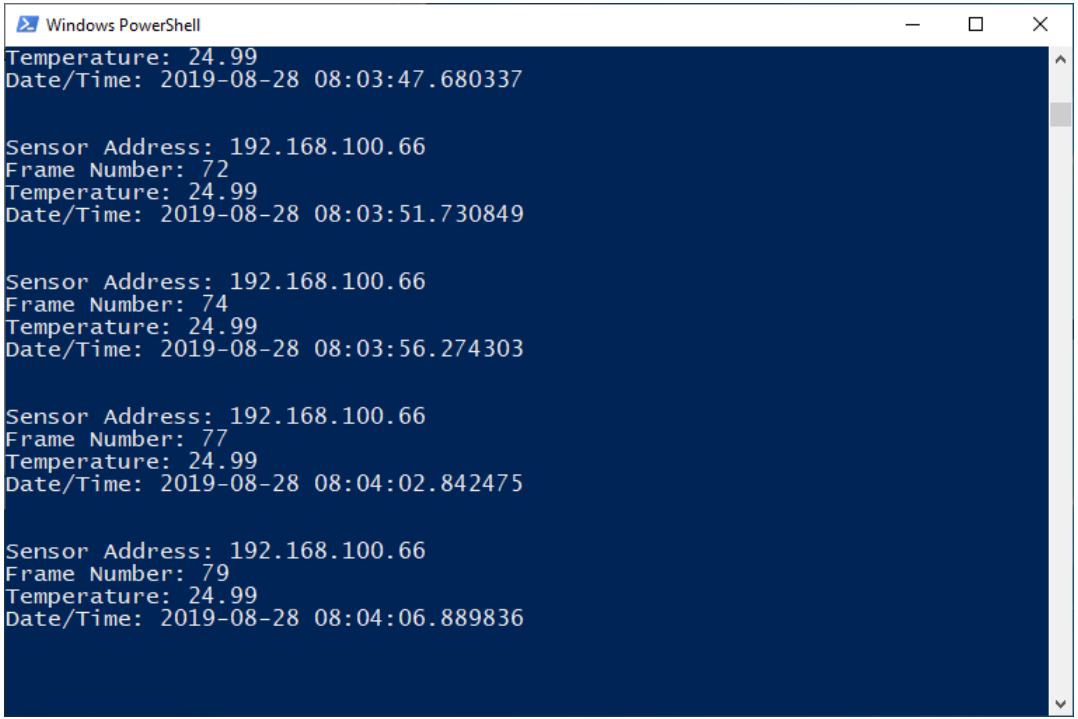
Communication Interface



Prototype



Data Reception

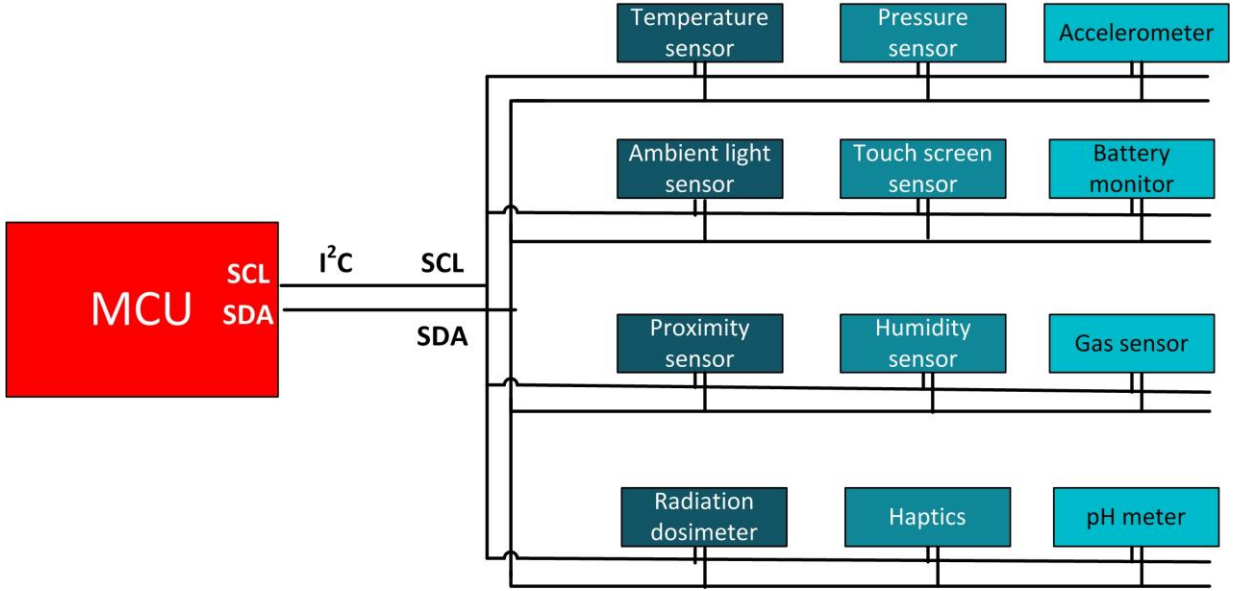


Scaling-up

Single master multiple slaves

Sleep mode when not in use

Data analytics



Source: https://e2e.ti.com/blogs_/b/analogwire

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Thank You