Raspberry Pi based Data-logger

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Raspberry Pi based Data-Logger

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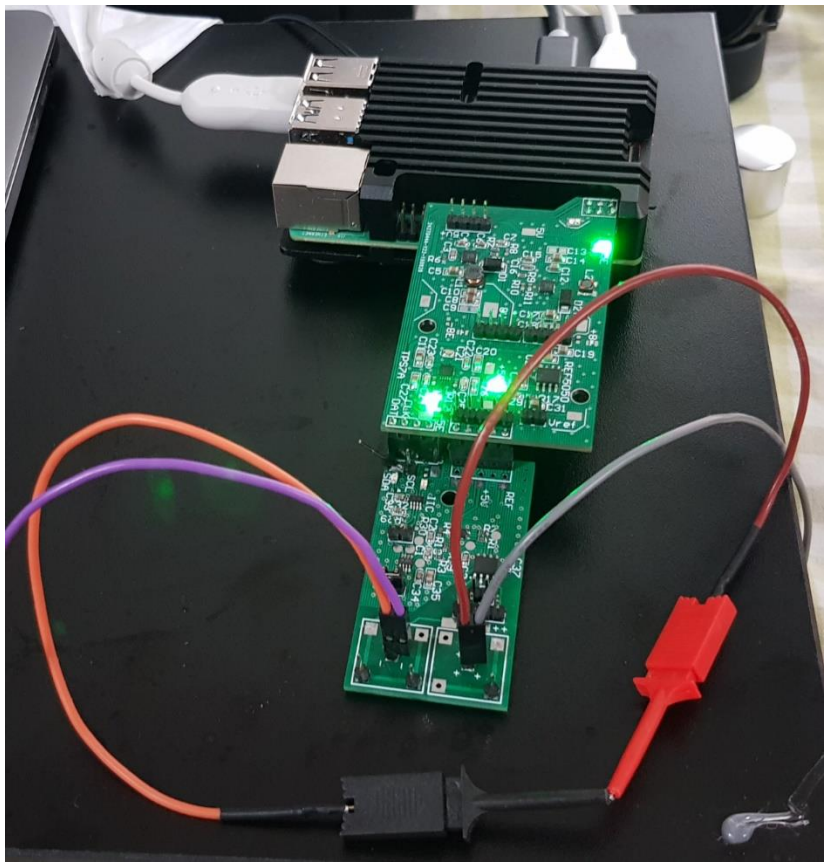
Introduction

1. Requirement
2. Hardware design
   - Power
   - Analog to Digital converter
3. Software design
   - Basic function
   - Human interface
4. Result
5. Conclusion



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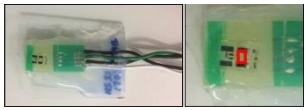
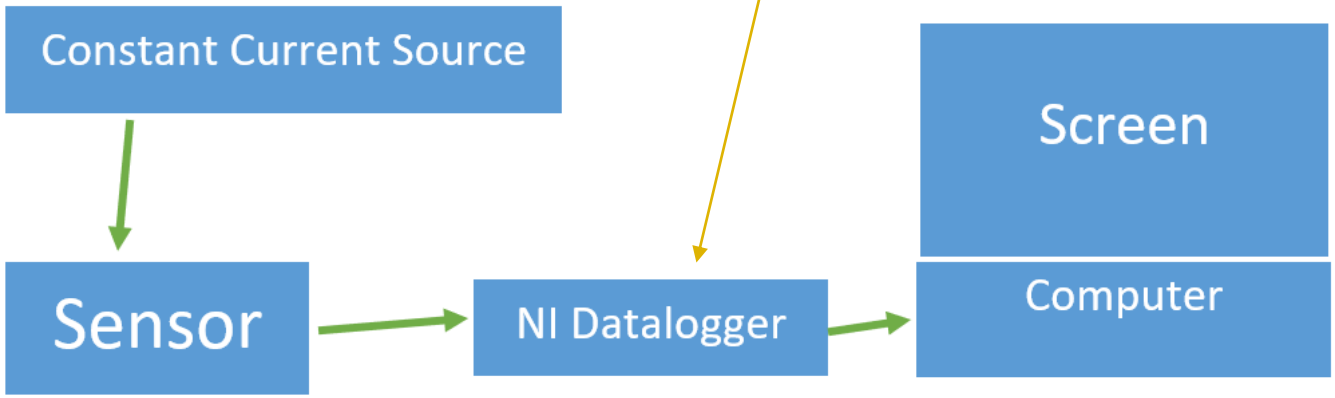
Requirements – Part1

Equipment using right now	
Datalogger	NI 9239
USB Chassis	NI cDAQ -9171
Computer	Windows computer
Price>5000$	Include software and hardware



AlGaN/GaN Sensor Device2 and Gate area



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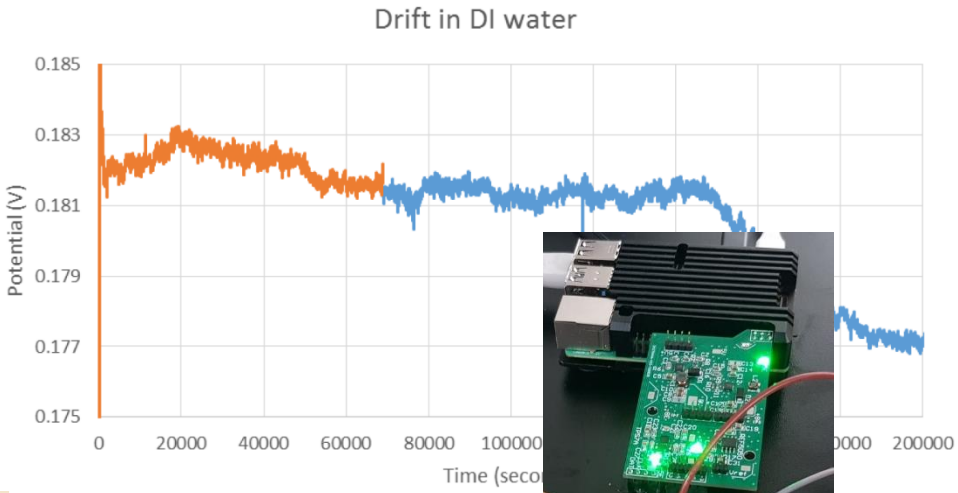
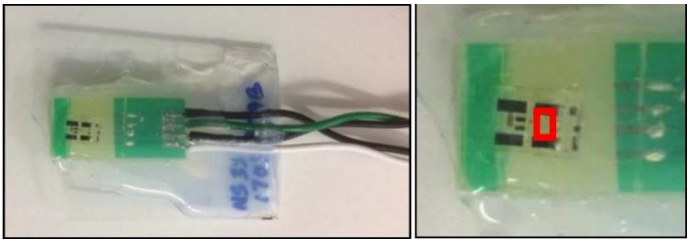
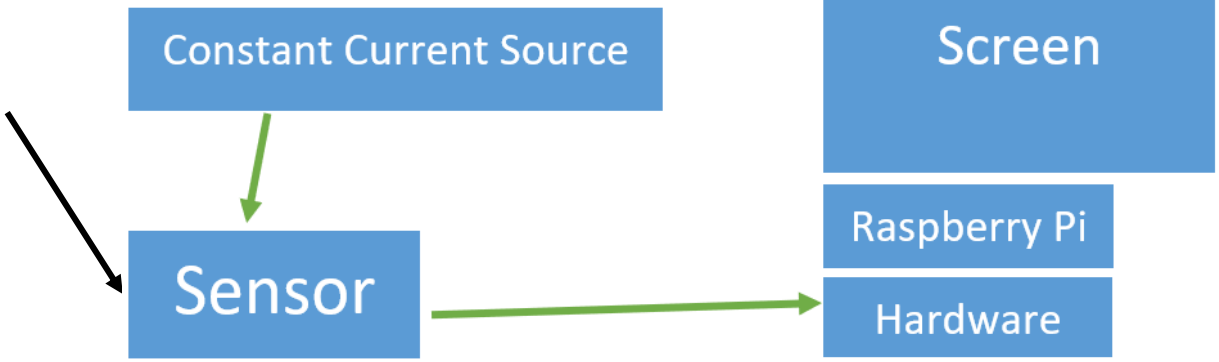
Requirements – Part2

Requirement	
Speed	>1kS/s
Input Range	±5Vpp
Power supply	Directly powered by Raspberry Pi
Resolution	0.1mv





AlGaN/GaN Sensor Device2 and Gate area（<10*10mm）



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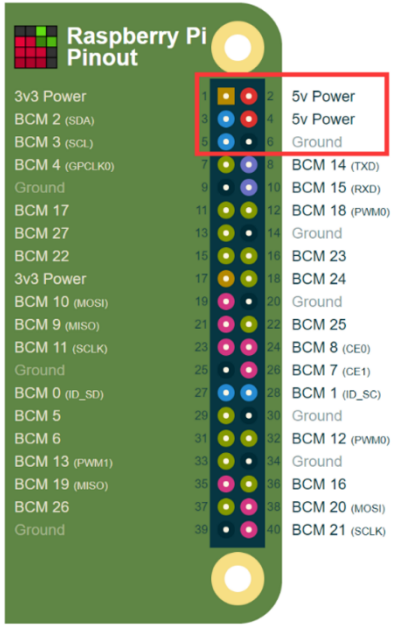
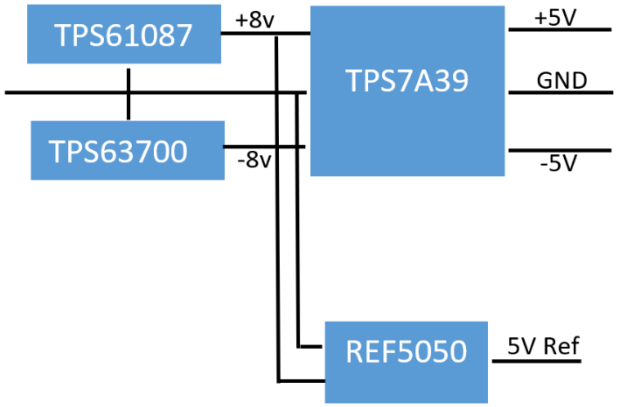
Hardware Design – Power supply Part1



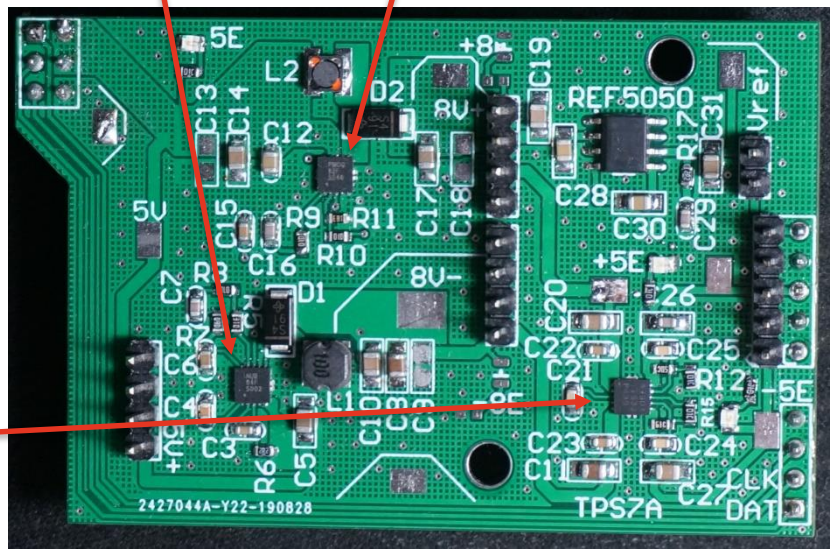


TPS61087 and TPS63700

- Buck and boost converter switch at 1.2MHz
- 10-Pin QFN Package

TPS7A39

- High-Precision Positive and Negative LDOs for High-Precision Analog Circuitry.
- High Power-Supply Rejection Ratio
  69dB(120Hz) and >50dB(10Hz to 2Mhz)
- 150mA per Channel



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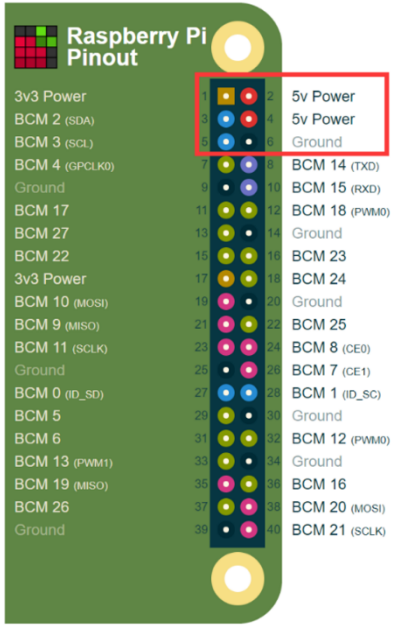
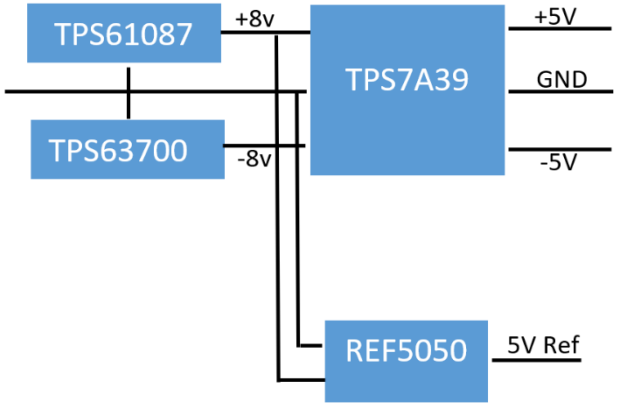
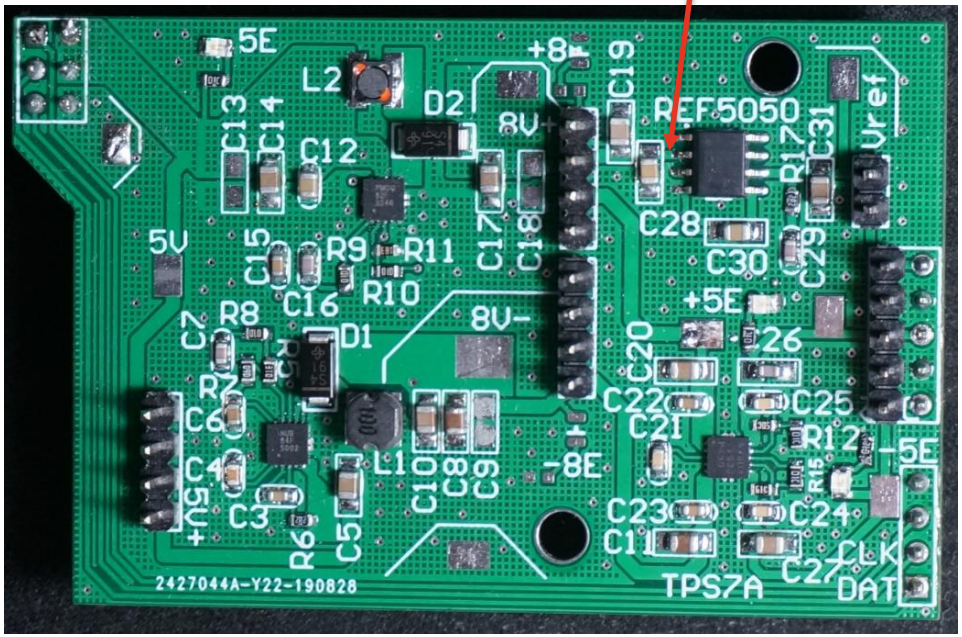
Hardware Design – Power supply Part2





REF5050

- Low temperature Drift:
  -Standard-Grade:8ppm/°C (Max)
- High Accuracy
  -Standard-Grade:0.1%(MAX)
- Low Noise: 3 μVpp/V
- Excellent Long-Term Stability



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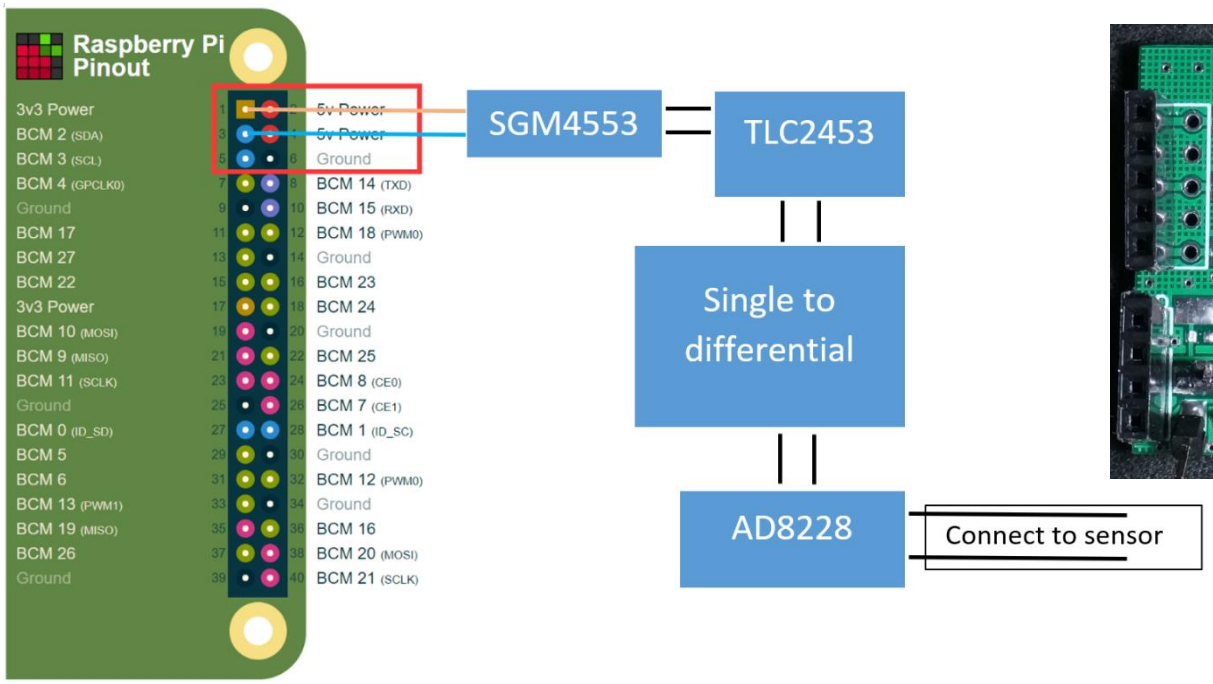
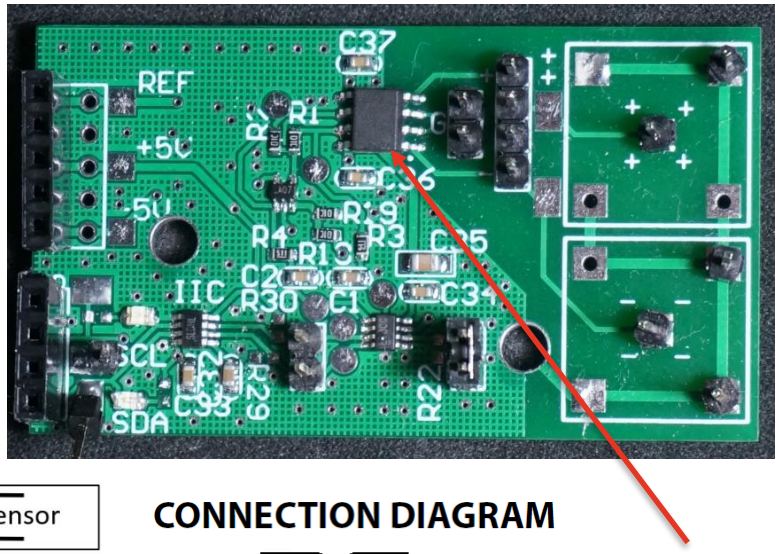
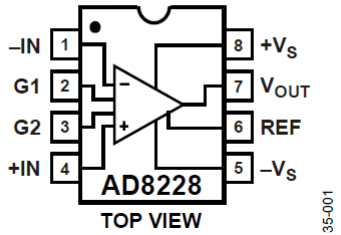
Hardware Design – ADC converter and front end Part1





CONNECTION DIAGRAM



AD8228

- High performance instrumentation amplifier with very high gain accuracy.
- Pin strappable gains of 10 and 100.
- Low noise: 8 nV/√Hz 0.3uVpp from 0.1Hz to 10Hz

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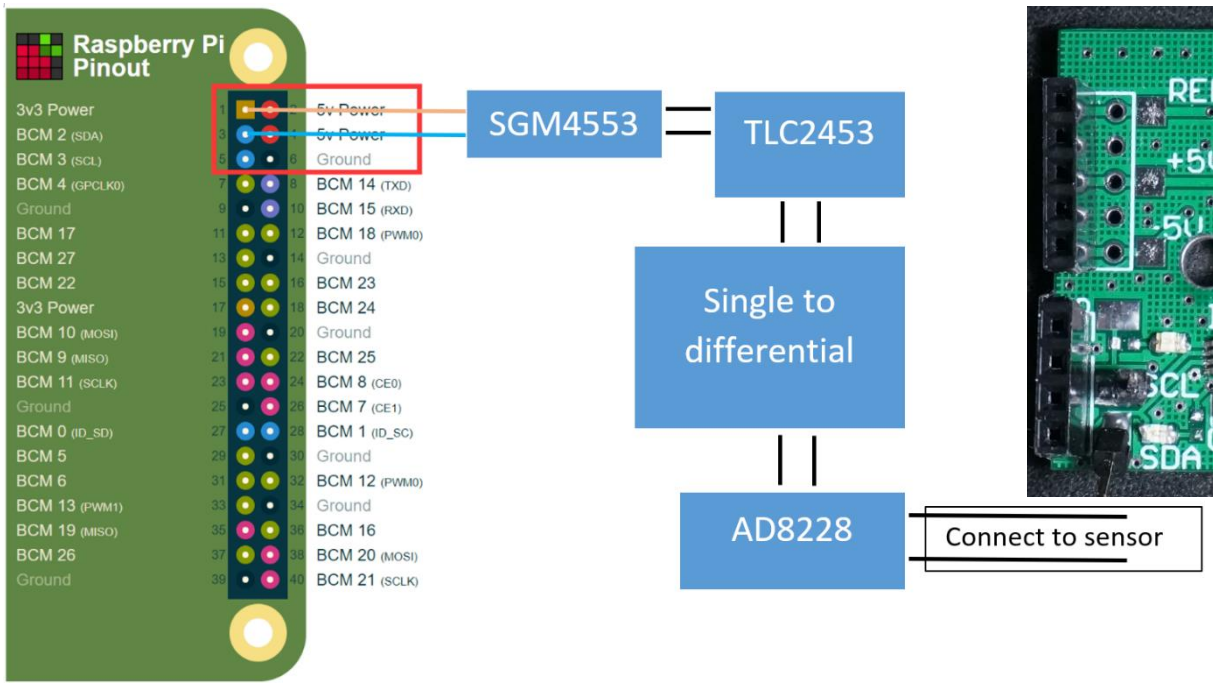
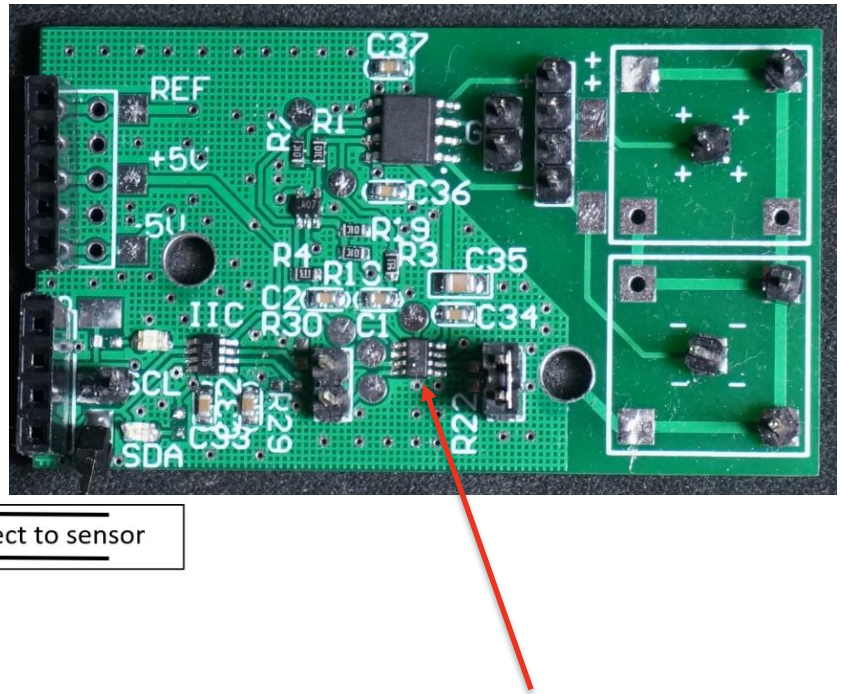
Hardware Design – ADC converter and front end Part2





LTC2453

- 16Bit ΔΣ ADC with I2C interface
- 2LSB offset Error
- Differential input range
- 60 conversions Per Second

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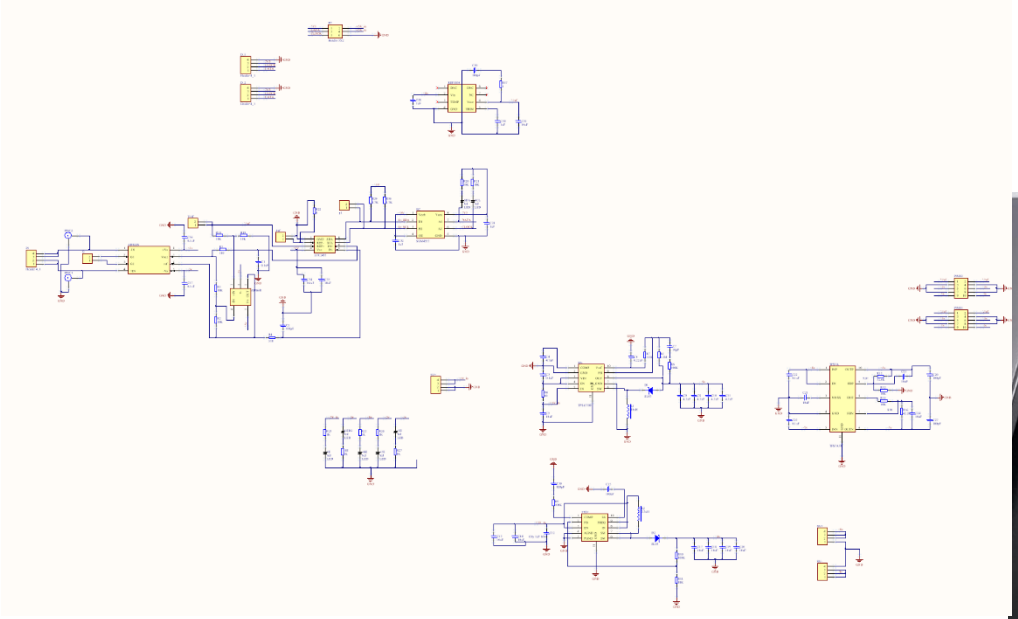
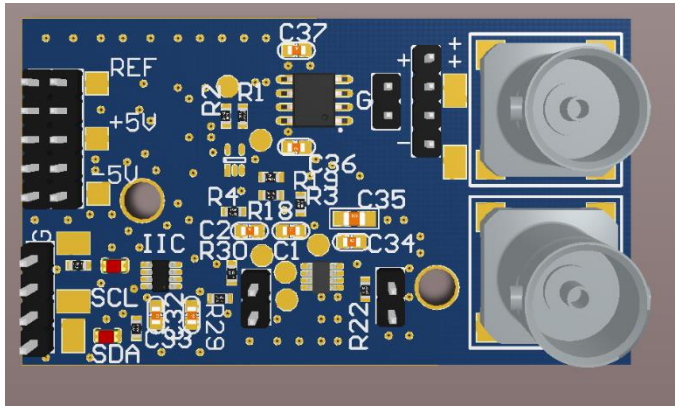
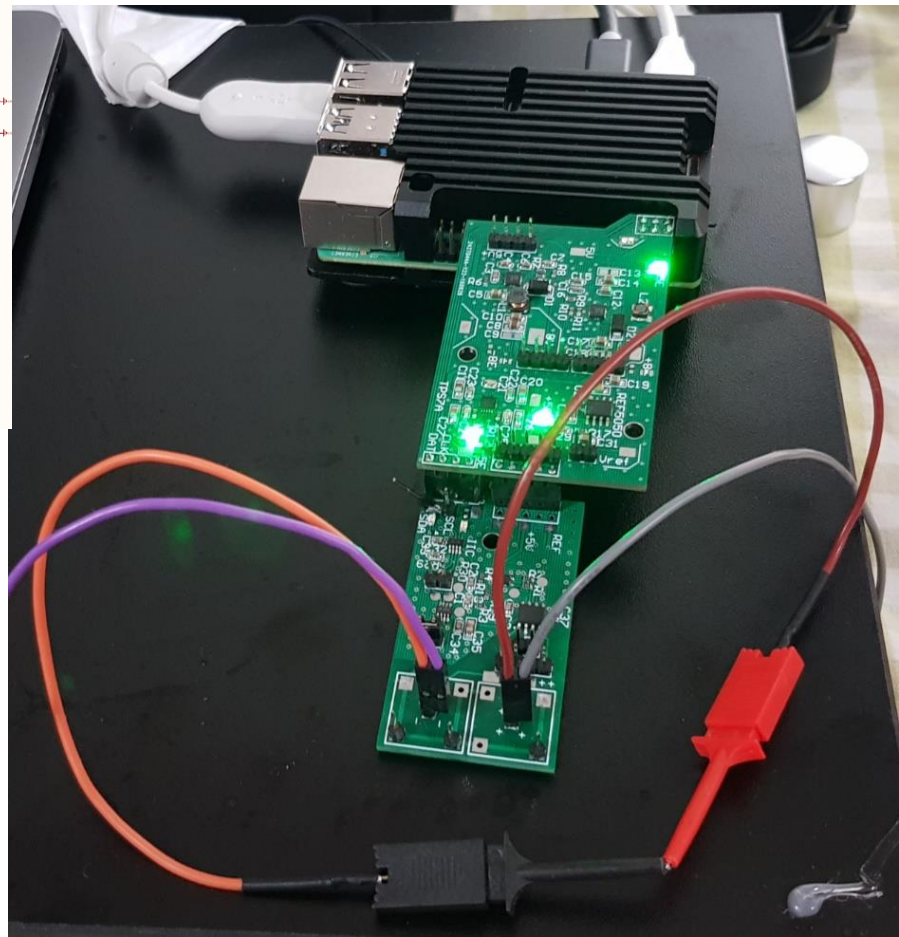
Hardware Design – Result







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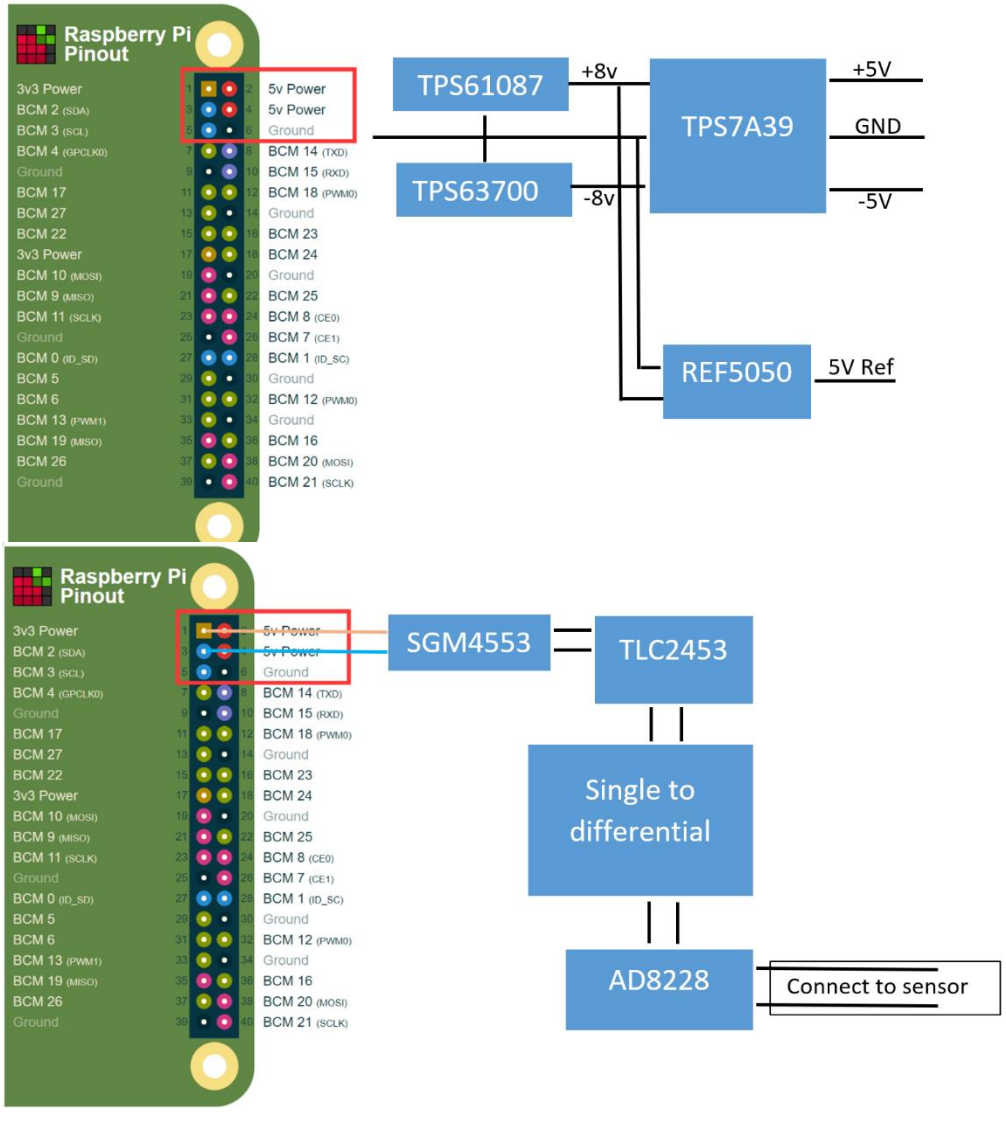
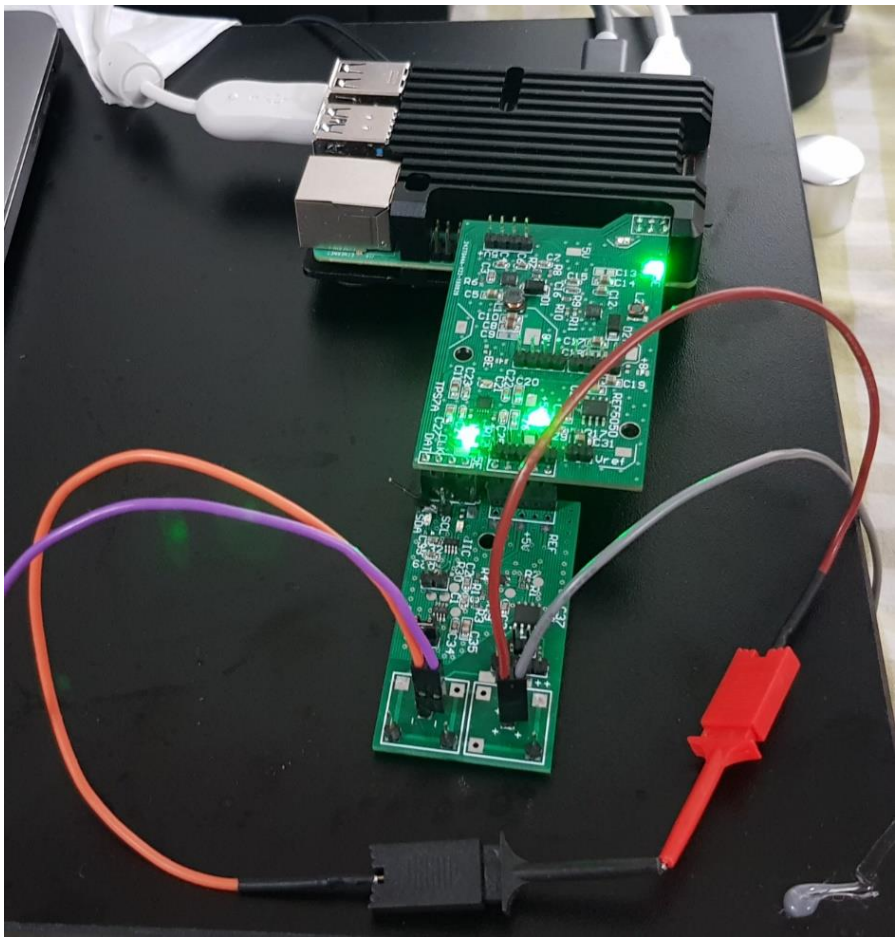
Hardware Design – Result





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Software Design

- Smbus2

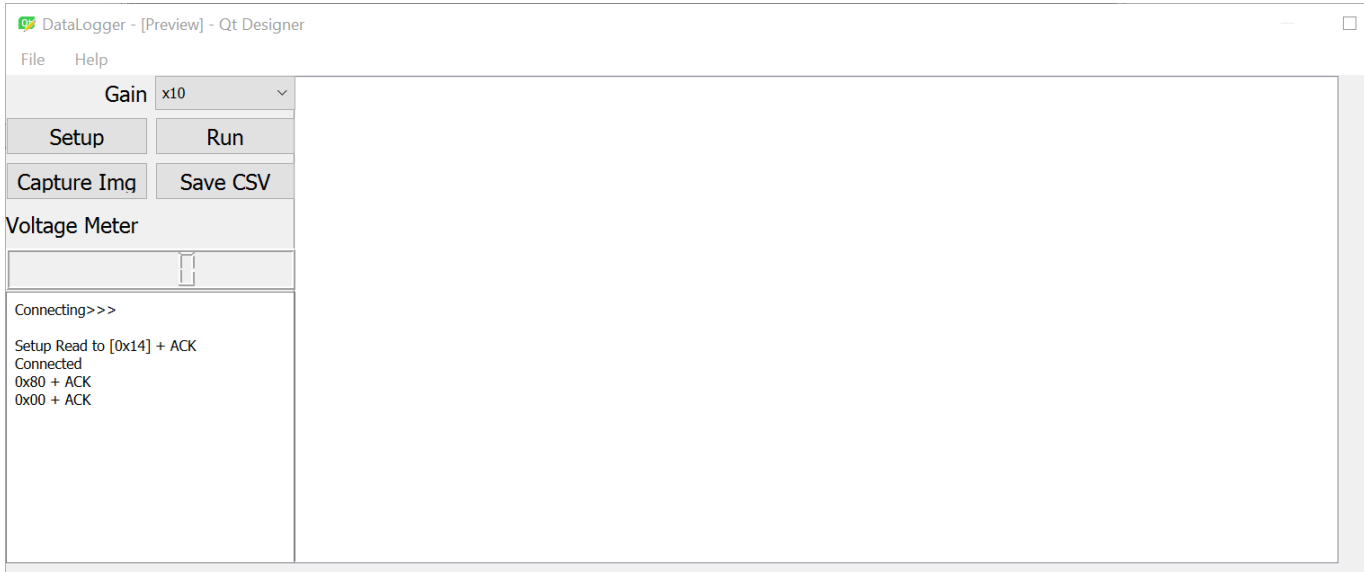
  I2C interface to let Raspberry pi can easy to communicate with ADC

- QT PySide2 for Raspberry Pi

  A official Python module from Qt for Python project. Which provide access to the complete Qt 5.12+ framework.

- Matplotlib for 2D plotting

  A Python 2D plotting library which publication quality figures in Python scripts



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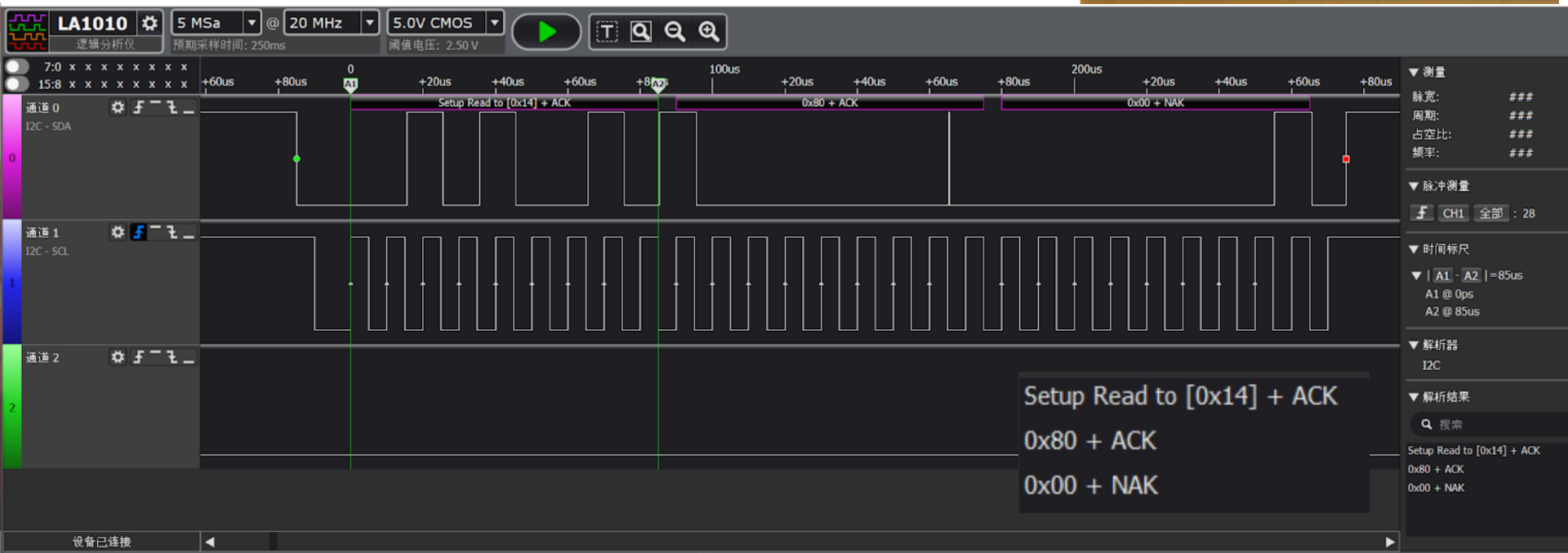
Software Design – I2C interface

- smbus2_0.30
  - Pure Python
  - Drop-in replacement of smbus
  - easy to use directly in Python

```
>>> b = bus.i2c_rdwr(msg)
>>> data = list(msg)
>>> print(len(data))
2
>>> print(data)
[128, 0]
>>>
```



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Software Design – PySide2

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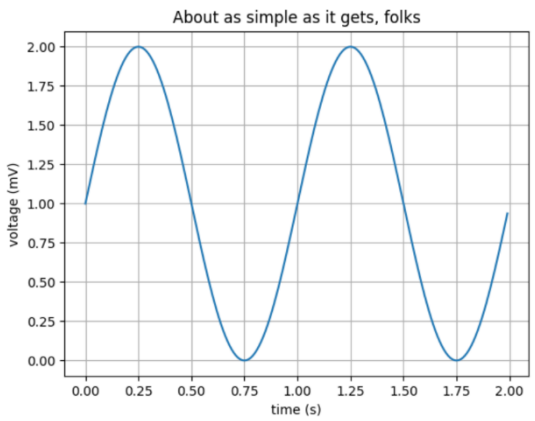

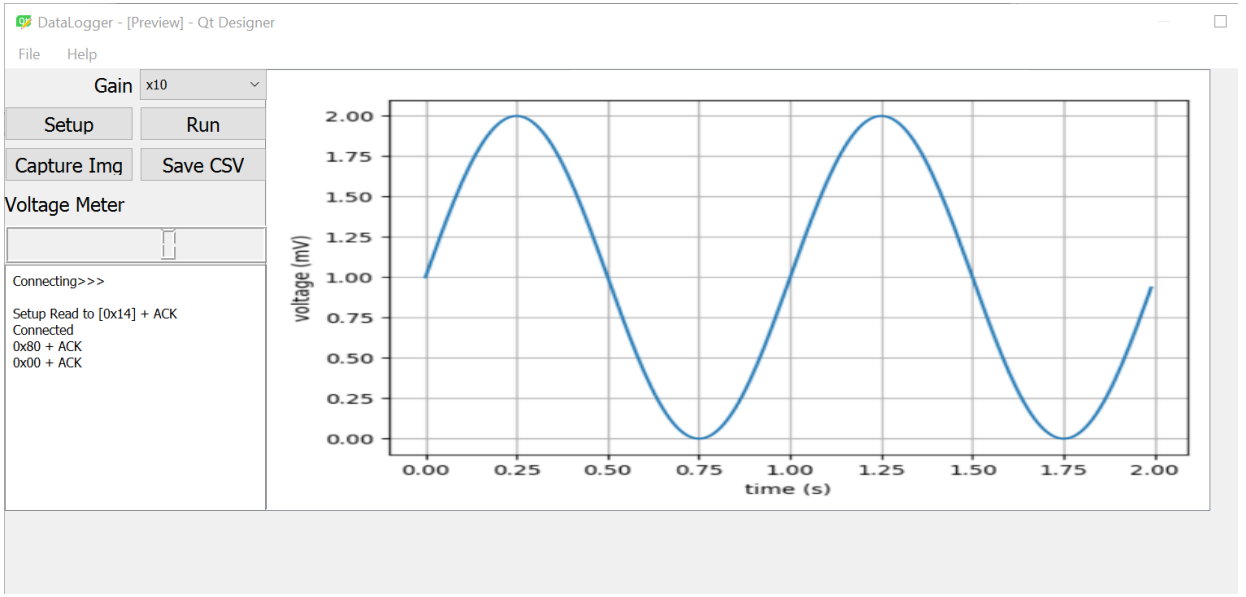

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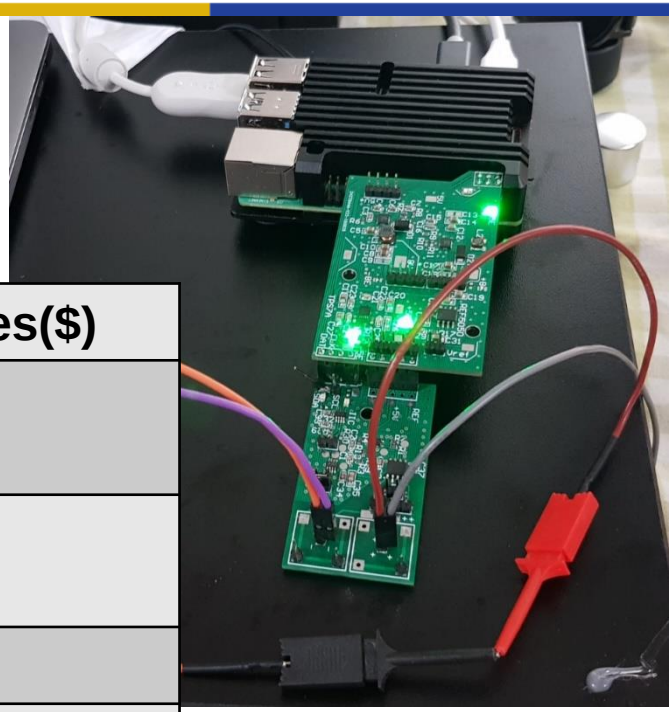

Result

- Price

		Prices($)
Single Board Computer	Raspberry Pi4 2G RAM	60
Analog to Digital Converter	LT2453 16Bit	4.87
AMP	AD8228	7.9
Voltage reference	REF5050	4
DCDC Boost	TPS63700	2
DCDC Boost	TPS61087	2
High precise linear regulator	TPS7A39	6
PCB	5pcs PCB	3
Total		89.77

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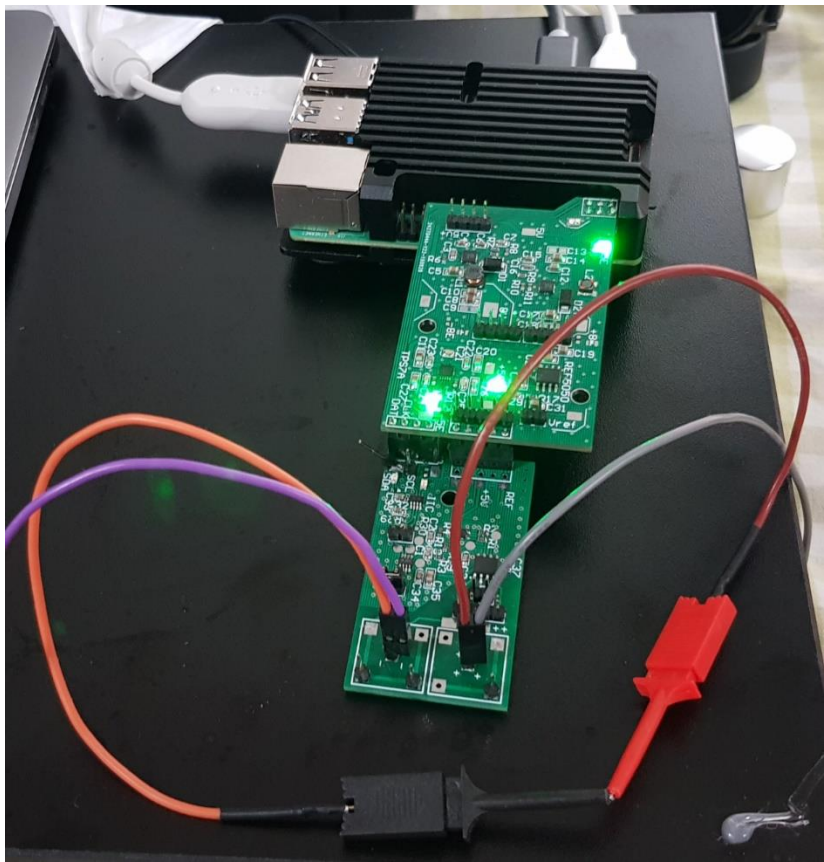
Conclusion

- Future work
- Protection
- Isolate power supply



Thank you for listening

Also thanks for Brett, Gilberto and
Jeremy helps me a lot of this project