Wireless Sensor Network for Radiation Monitoring at Argentinean Nuclear Research Reactor RA-6.

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Introduction
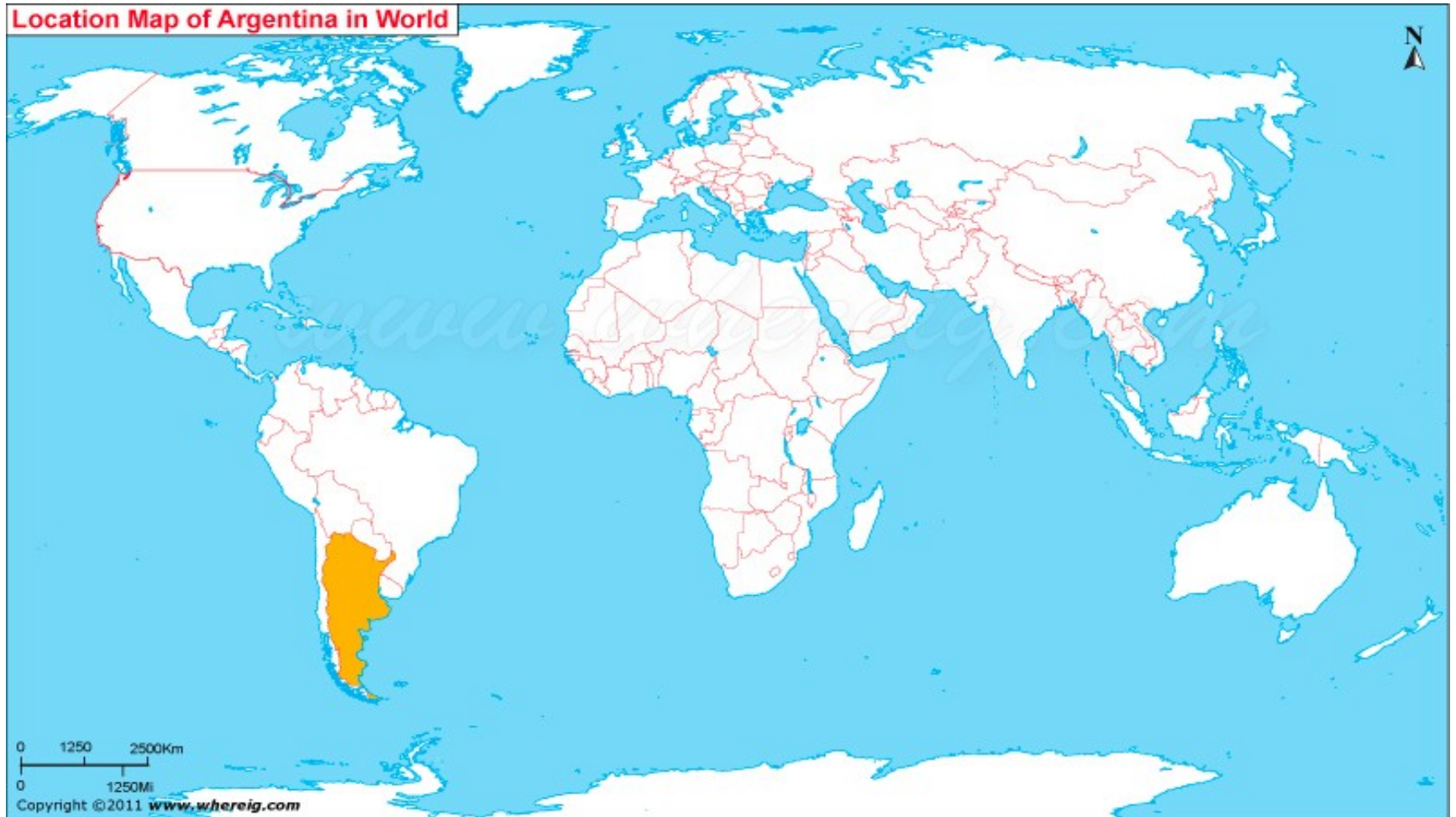
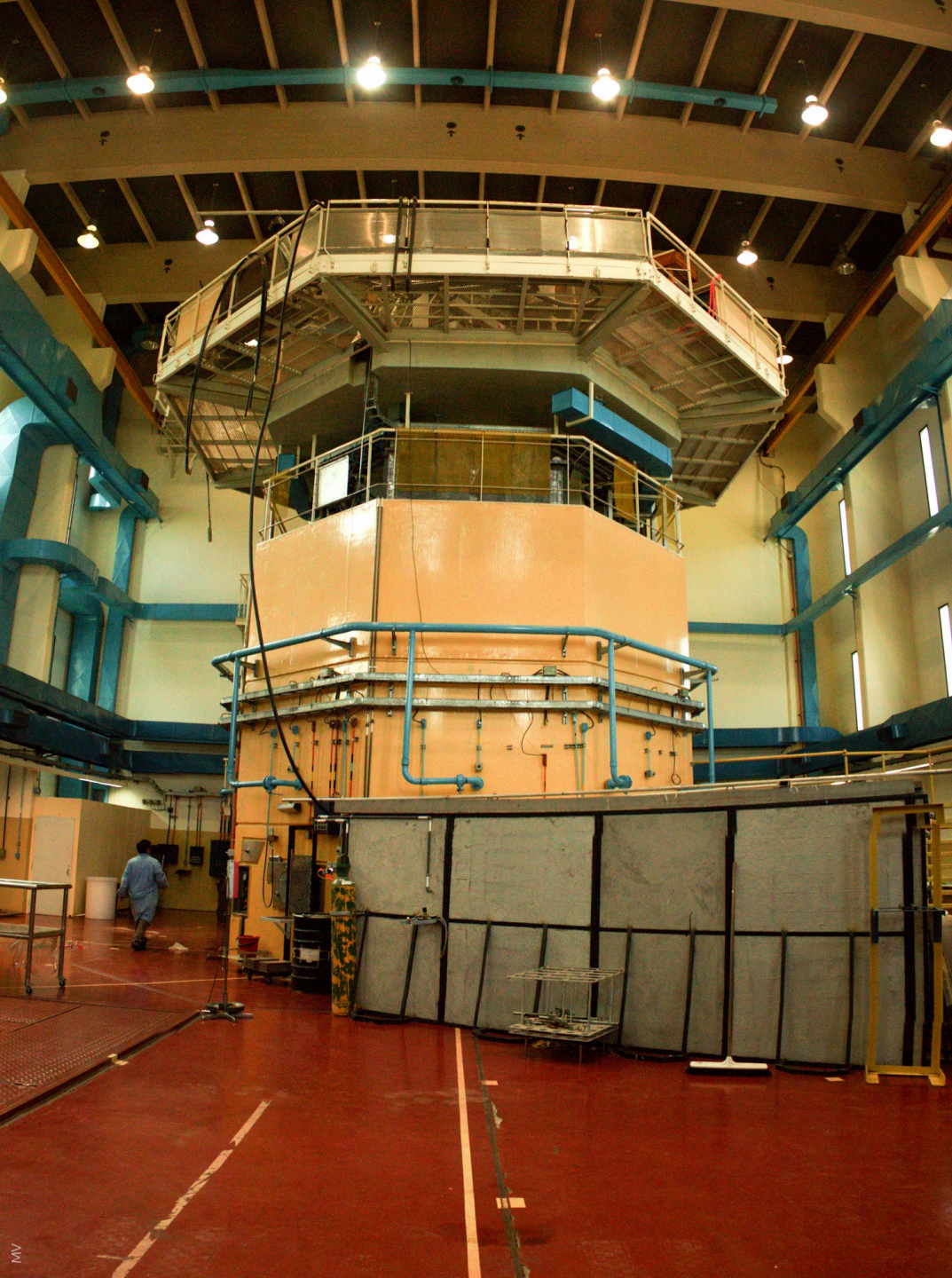We want to develop a WSN to measure environment including radiation, for two reasons:

1. To be introduced as a Conventional Instrumentation System. Back up system.

2. To measure environment around the reactor to have data online for training and research.

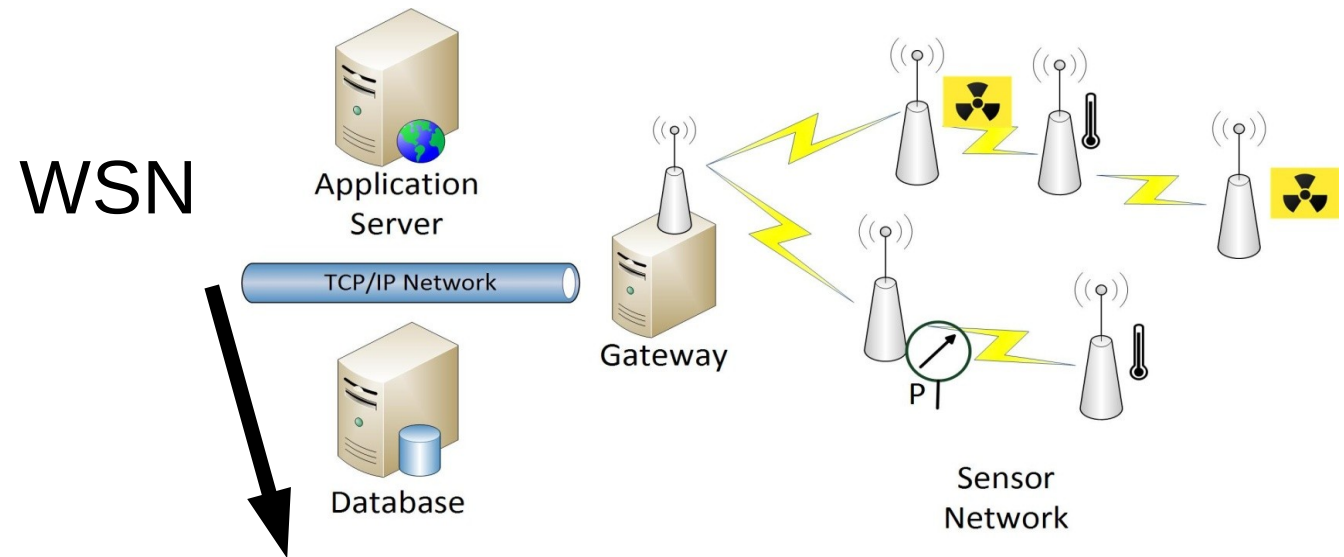# Argentina, San Carlos de Bariloche

Bariloche

RA-6
Nuclear Research Reactor

Is an open-pool multipurpose reactor, used for training and research, was built in 1982 with an 2MW thermical power
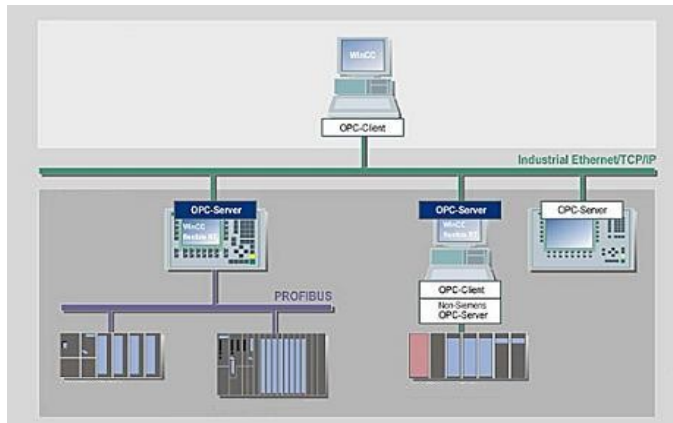
RA-6 (outside)

Challenge

WSN

I&C

WEB

Ionizing
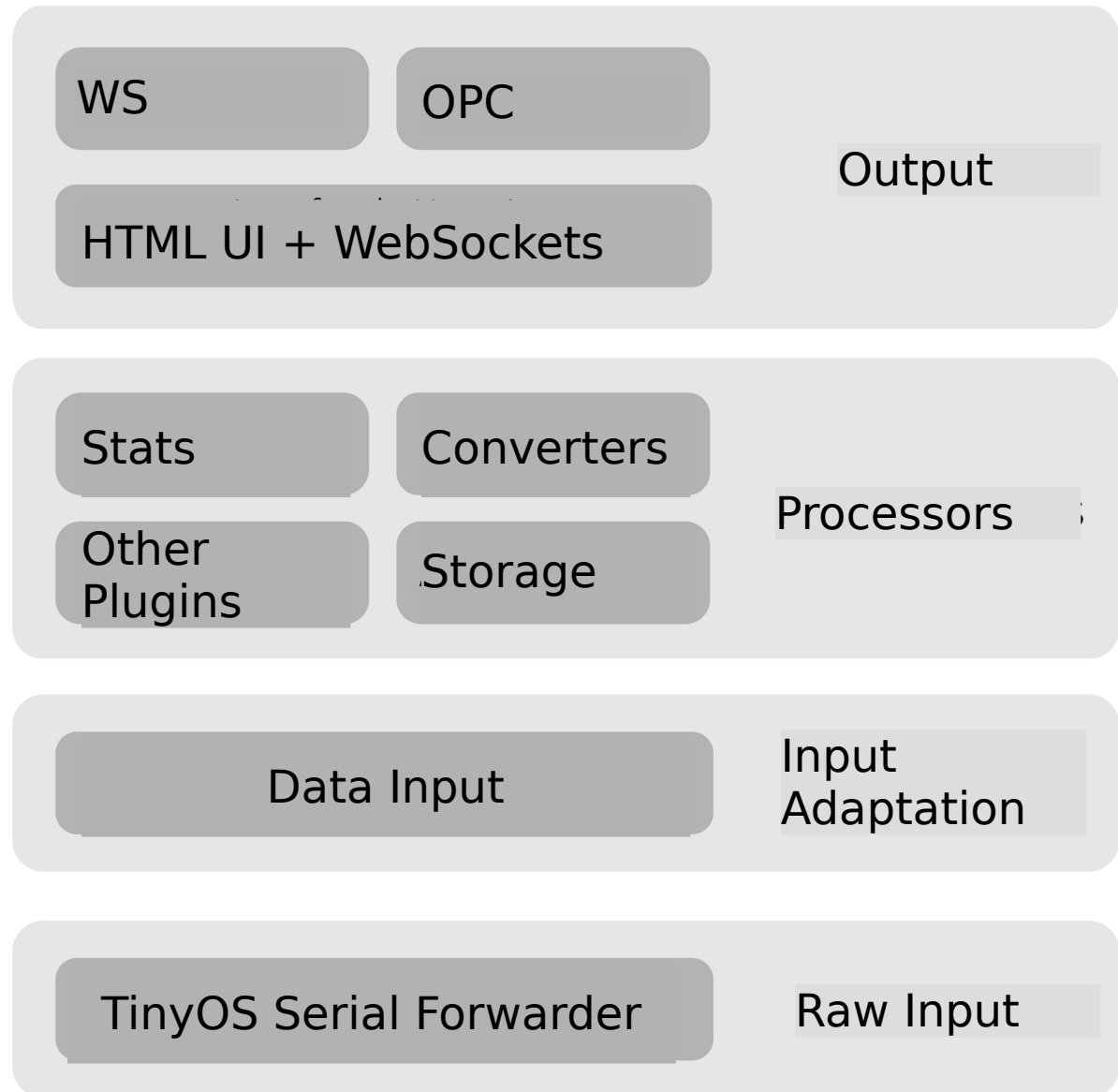Radiation

Instrument System Information

Middleware

Built with Python and the Twisted Framework
Can handle all the TinyOS Network
Datatypes augmented with semantical
annotations.

Uses a event driven architecture to recieve,
process and push data to other services.

High Level Architecture

- Plugins at every level

- Ready to accept other kinds of inputs, tasks and outputs

WS

OPC

Output

HTML UI + WebSockets

Stats

Converters

Processors

Other Plugins

Storage

Data Input

Input Adaptation

TinyOS Serial Forwarder

Raw Input

SenseMsg `121`

Documentación

```
Original packet definition:
    typedef nx_struct SenseMsg{
        nx_uint8_t MoteId;
        nx_uint16_t Sqn;
        nx_uint16_t VccMote;
        nx_uint16_t Temperature;
        nx_uint16_t Humidity;
        nx_uint16_t ActiveRadiation;
        nx_uint16_t TotalLight;
    }SenseMsg_t;
```
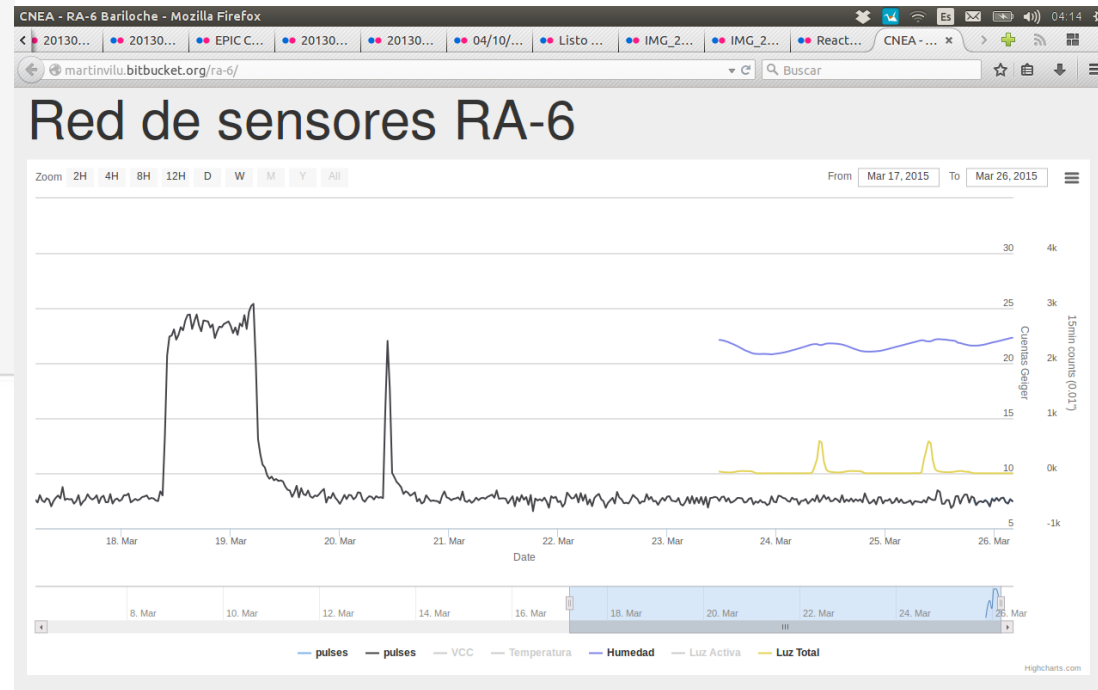
Estructura

MoteId	is identifier of int	1 bytes
Sqn	is sequence of int	2 bytes
VccMote	is measure of int	2 bytes
Temperature	is measure of int	2 bytes
Humidity	is measure of int	2 bytes
ActiveRadiation	is measure of int	2 bytes
TotalLight	is measure of int	2 bytes

Acciones
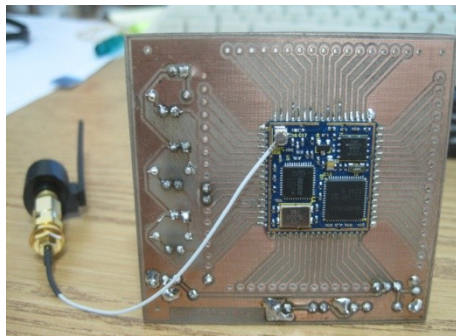
Ver ultimos

Semantics and Visualization

Mote Hardware used

Tmote Sky
EPIC Core
Zolertia Z1

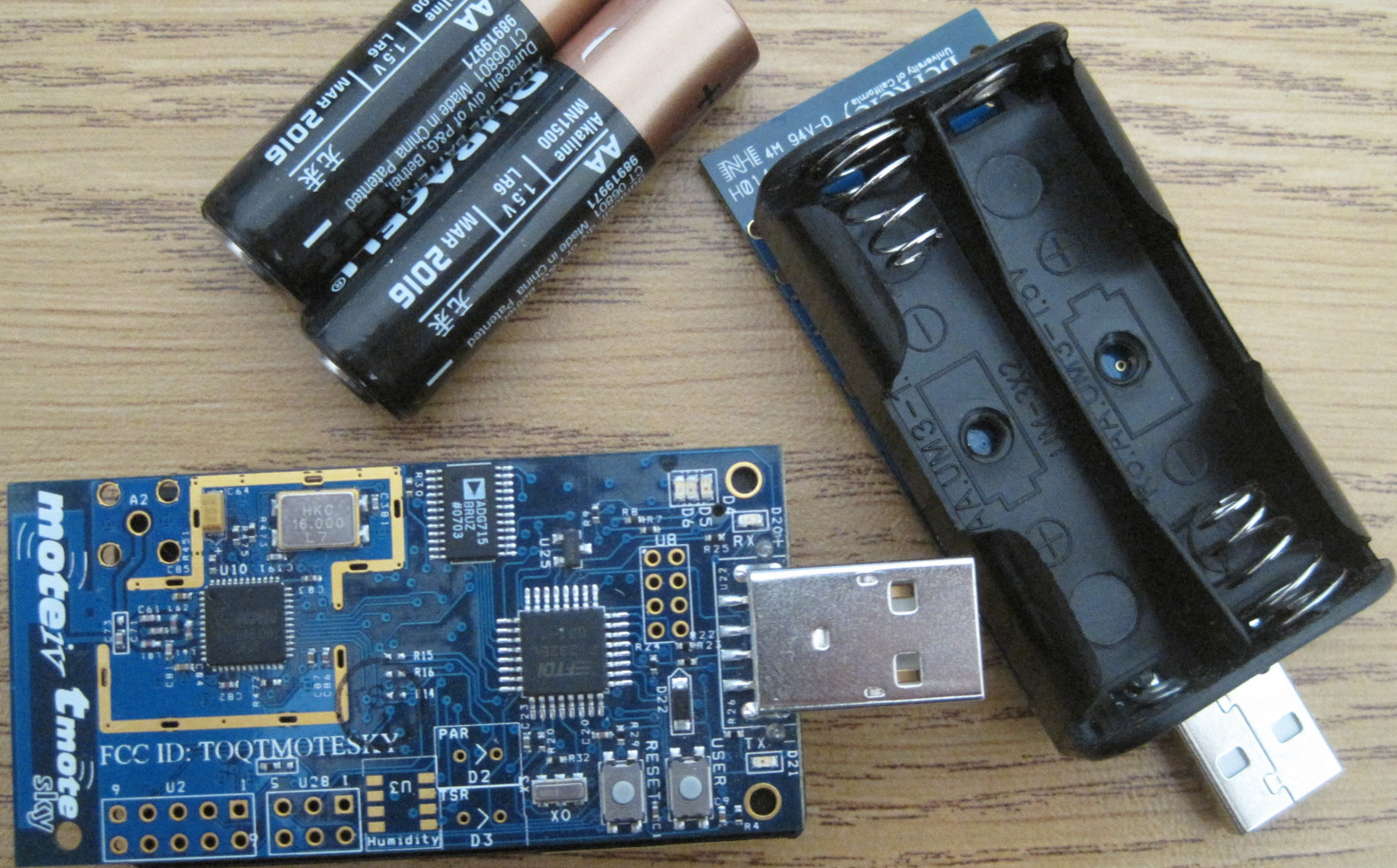All are an **ultra low power** wireless modules for WSN, compatible with TinyOS.

(+)Easy to deploy, low cost, low power, unreachable places
(-) New technology(nuclear industry, EMI, security)

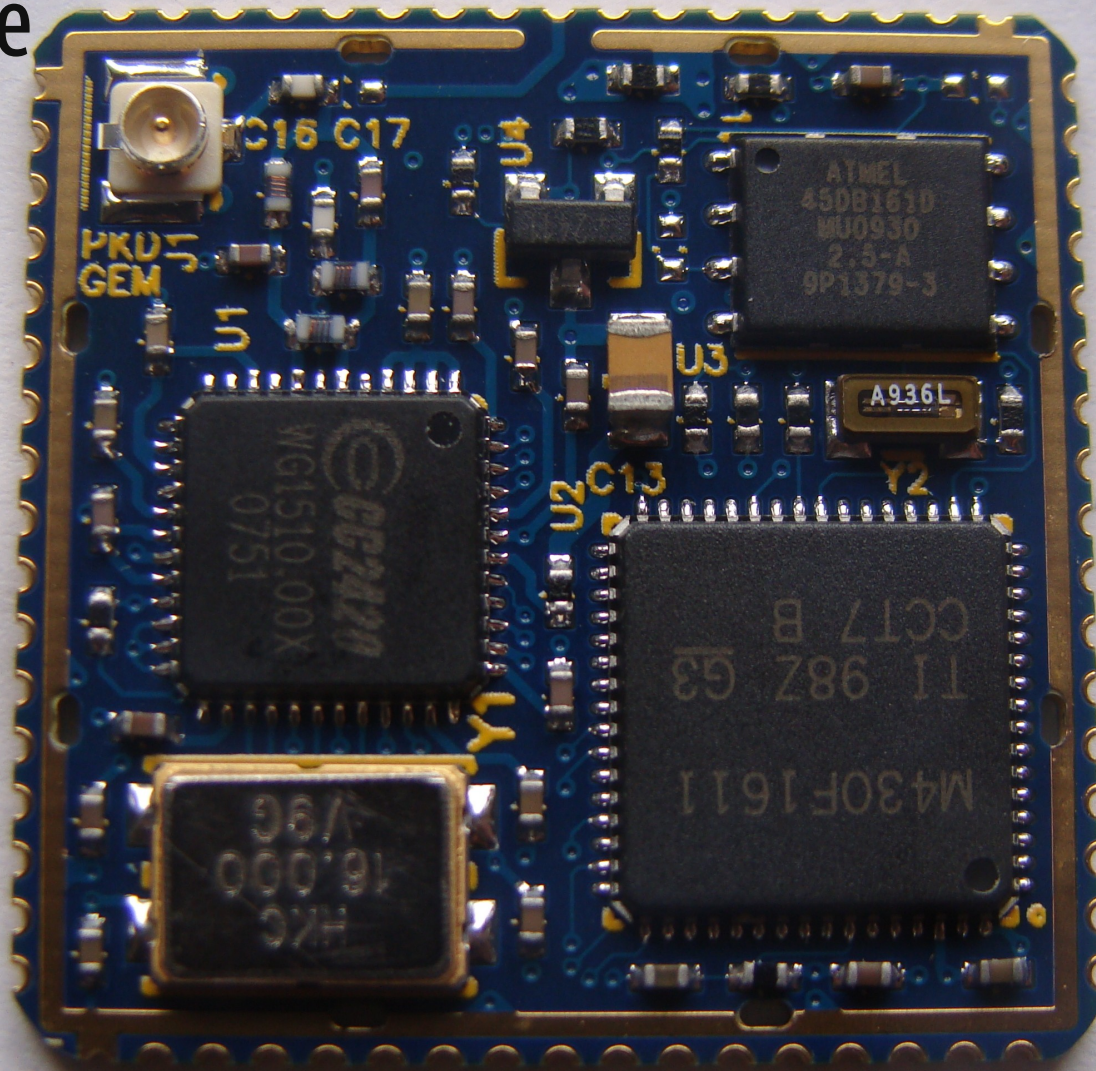All use 250kbps 2.4GHz IEEE 802.15.4
And a 8MHz MSP430 microcontroller

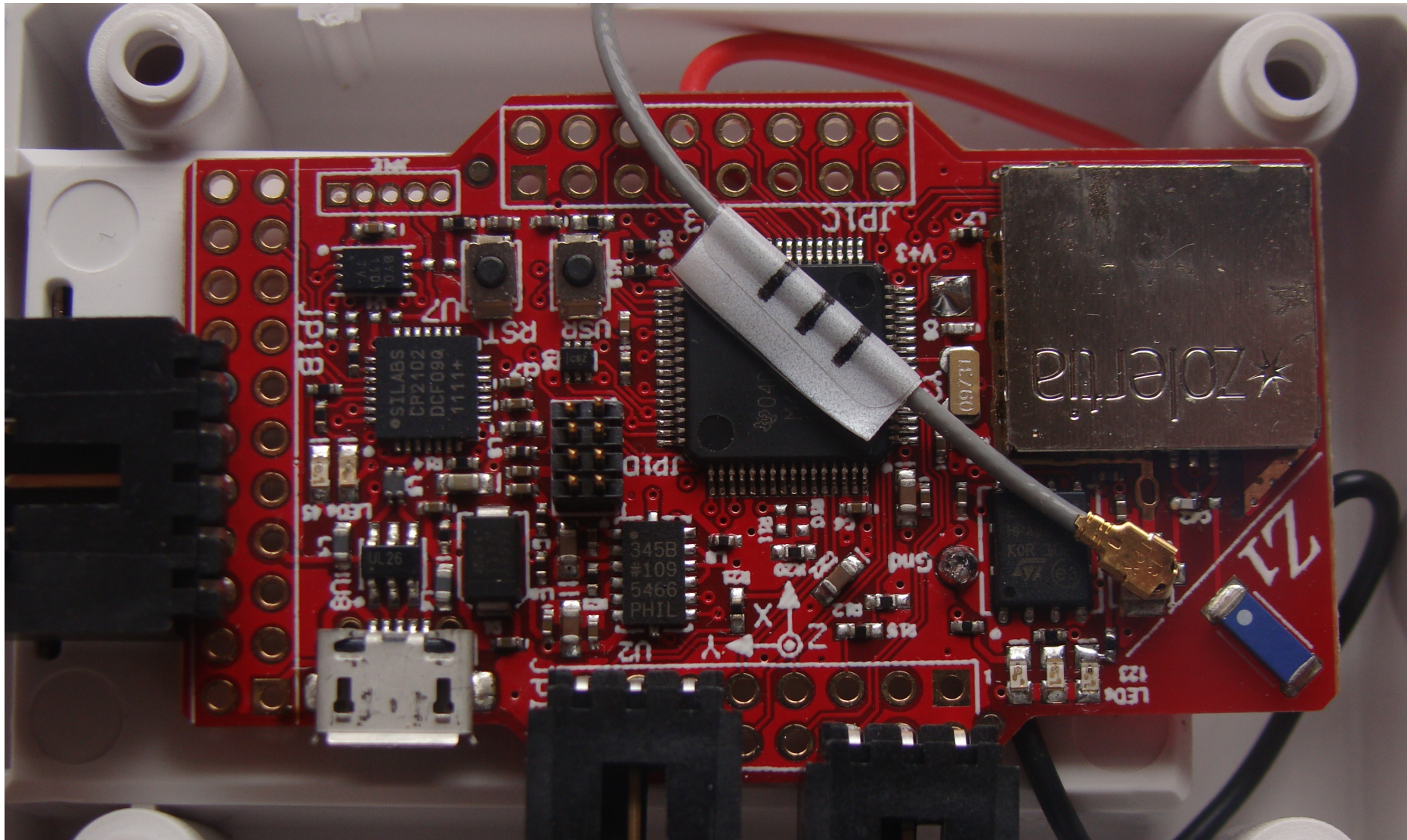TinyOS provides hardware abstraction, mesh networking and communication
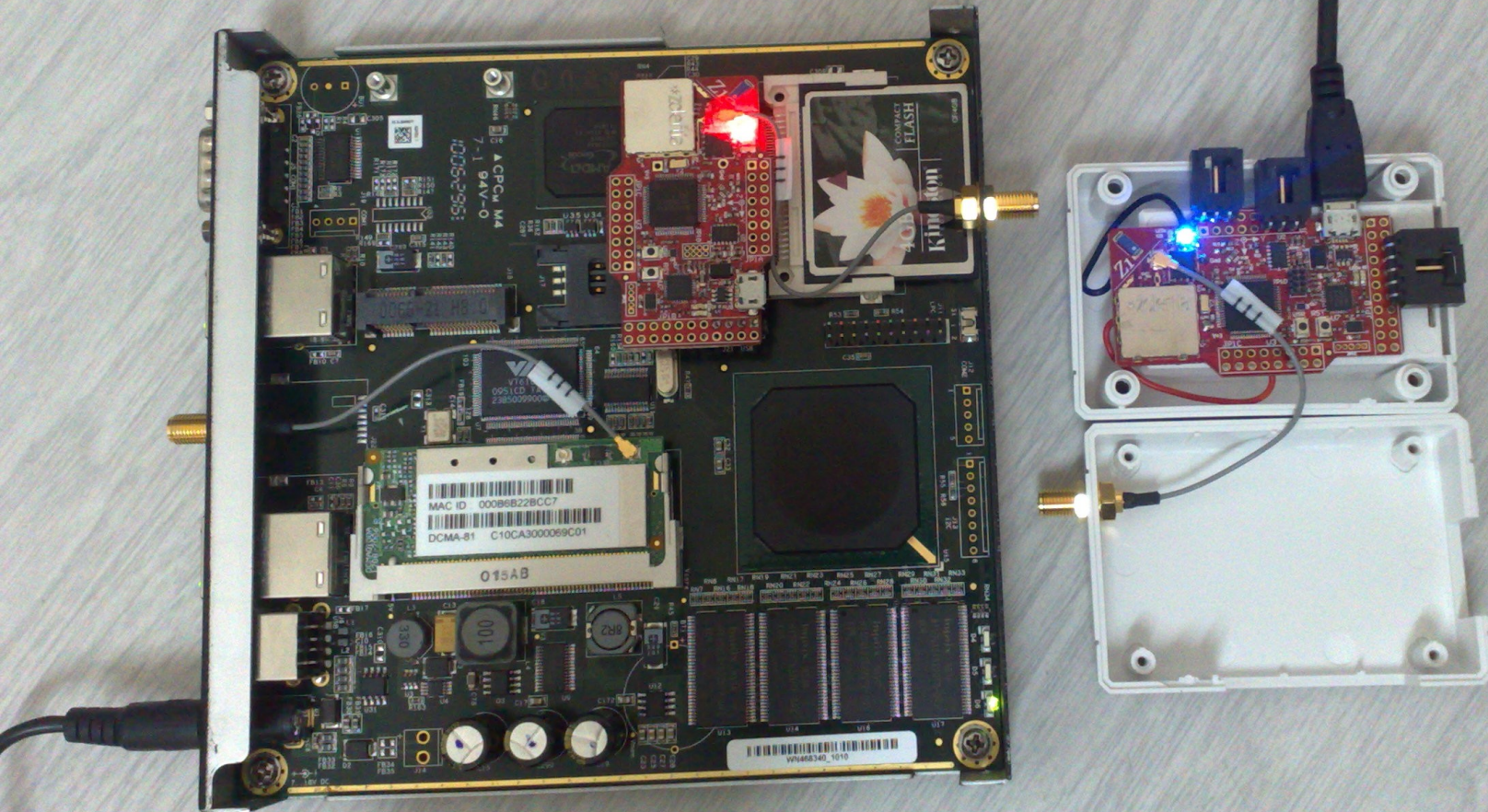
TelosB A.K.A. Tmote Sky

EPIC Core

I think you might know this one (Zolertia Z1)

Gateway Hardware (Alix II) – Zolertia

Radiation Sensor

Requirements
- Geiger Müller Tube
- Supply voltage 3V
- High voltage circuit (400-700V) from 3V.
- Low consumption
- Peak detector circuit
- Connection to a mote

First prototype
- Consumption <20mW
- HV circuit with selectable output to use different GMT.
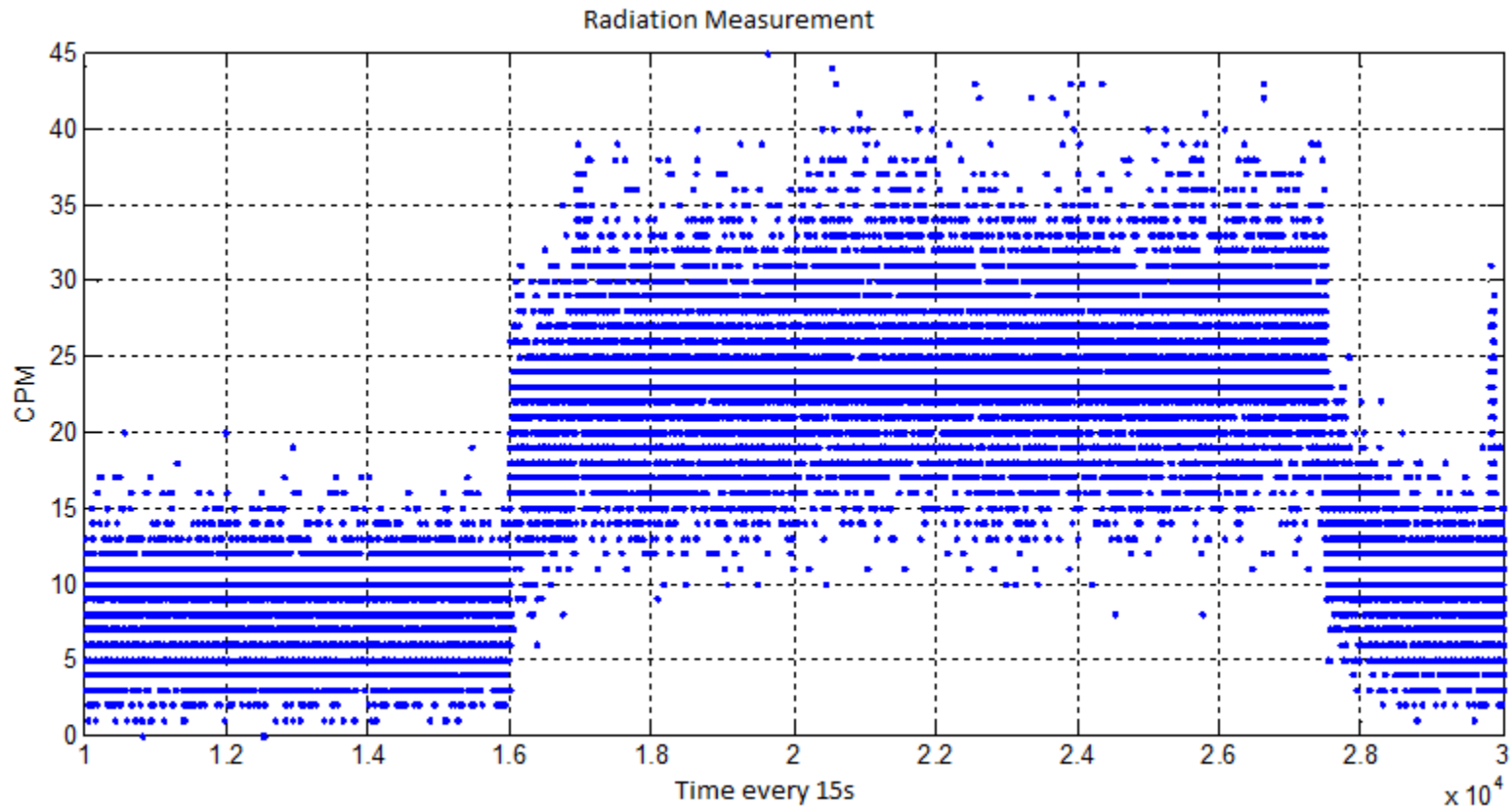- GMT with different sensibility used.
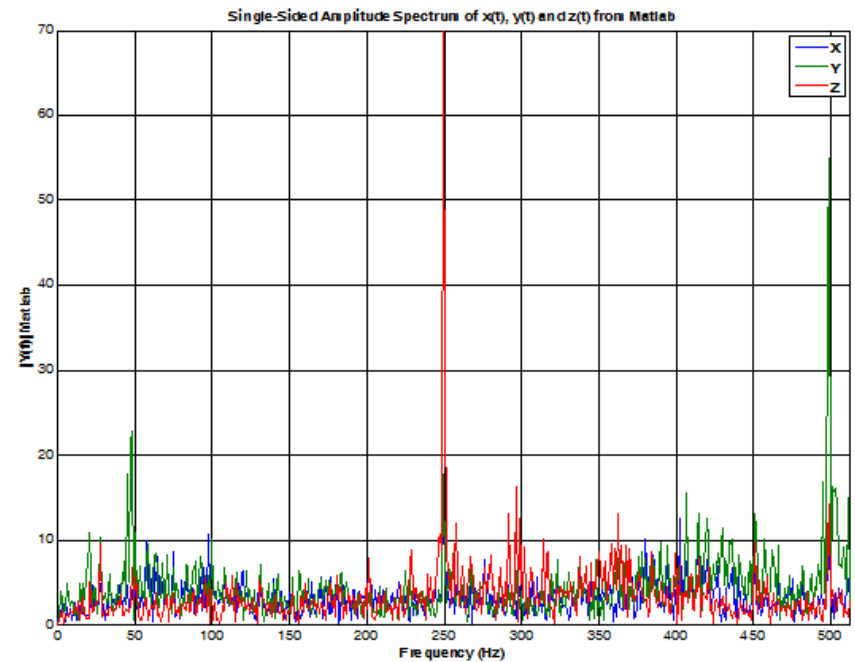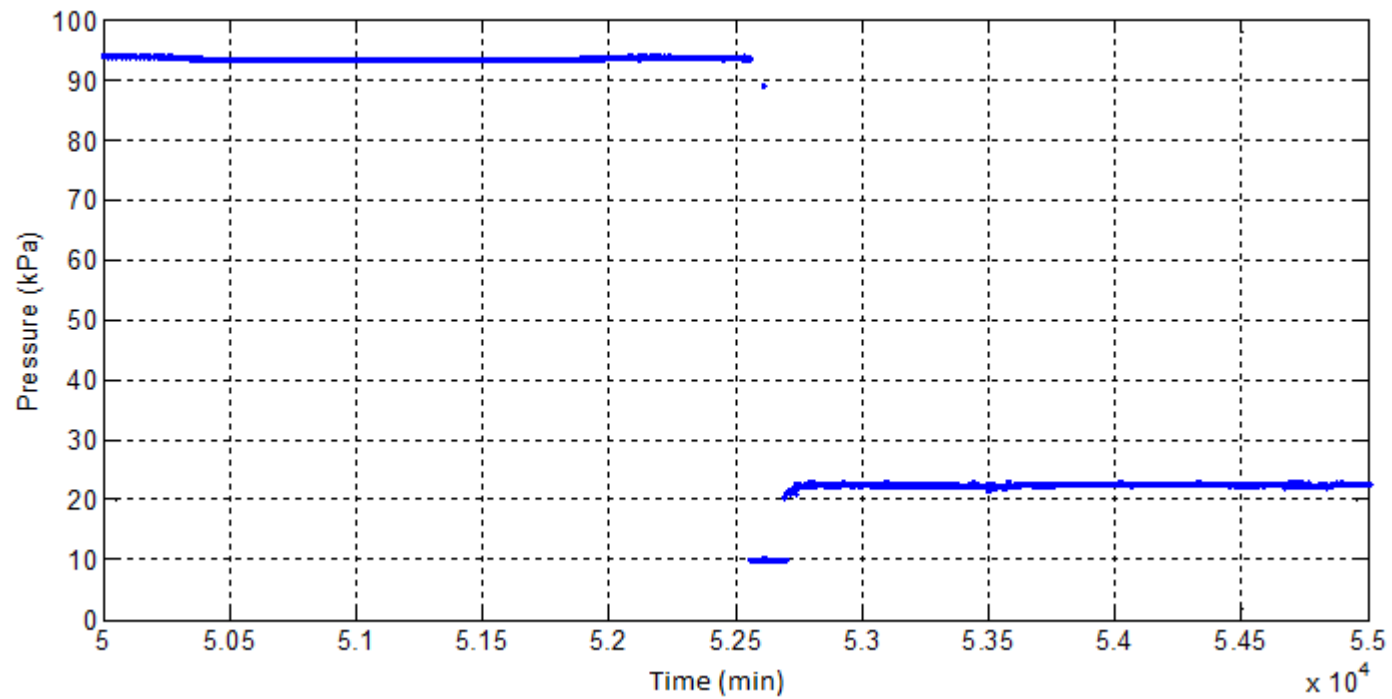- ZP1400, ZP1300, SI3BG, SBM-20

Deployed WSN

Equipment
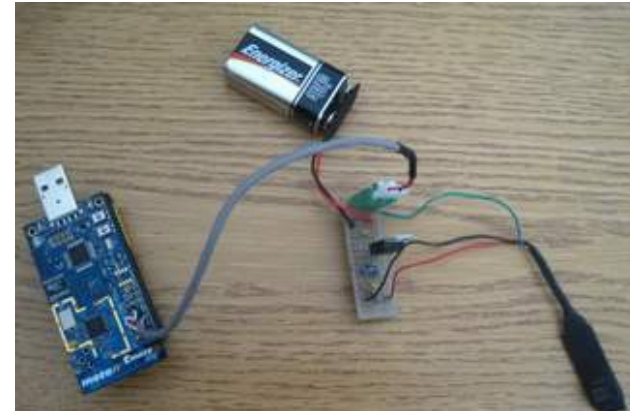
Deployment

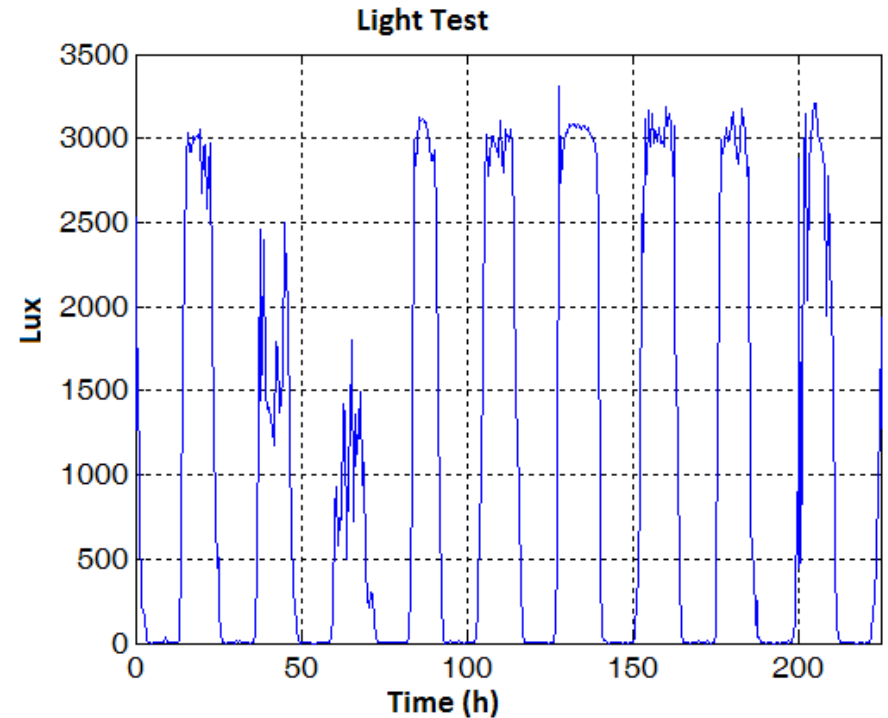# Radiation measurement.
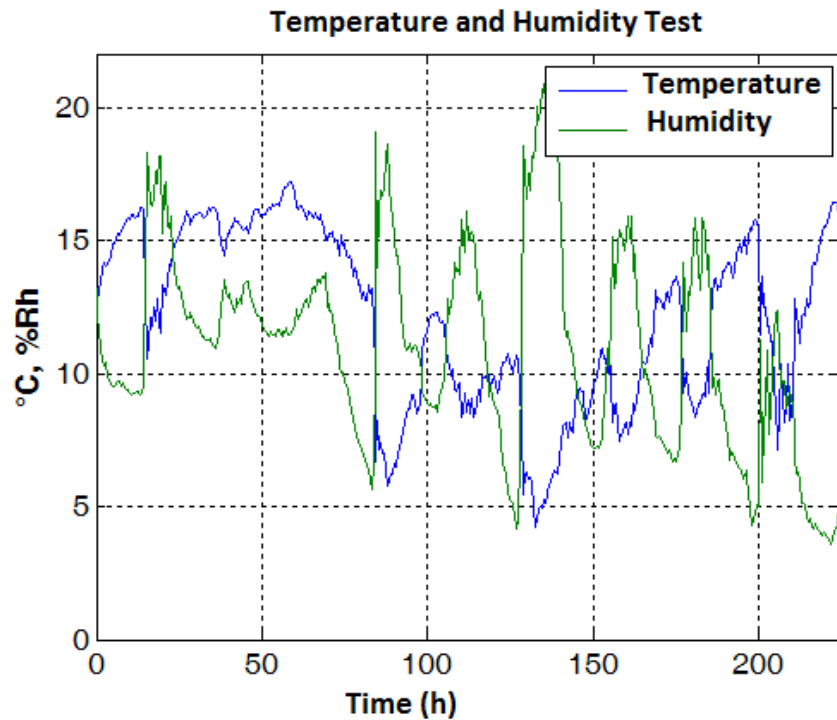

Radiation Measurement

Vibration

Pressure

Temperature, Humidity and lux

Sensors used:
Sensirion SHT 15
Hamamatsu S1087-01 and S1087

Conclusion

- A WSN was deployed in RA-6 RNN measuring:
  - Radiation, temperature, light, humidity, pressure and vibrations.
- Design of a low power wireless radiation sensor prototype based on GMT.

- Future work: Use the collected data to get statistics and further information.
- Build a bridge between WSN and I&C using industrial standards.

Contact

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¡Gracias! Thanks! ¿Questions?