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Innovative low-cost and open source turbidity sensor for monitoring urban water systems

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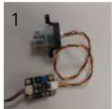
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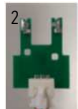
Material & Methods

☐ Require sensor upgrade & lock-in amplifier

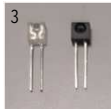
☐ Request a ruggedized and cheap encapsulation



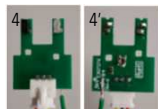
1
Turbidity sensor SKU SENO189 functional, but :
• not waterproof cover
• LEDs sunlight sensitive



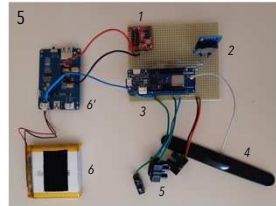
2
Original sensor PCB (top view)



3
Transmitter QEE113 & receiver TEKT5400S LEDs



4
Modified PCB : Emitting LED powered by a square wave signal (0-3.3 V) to subtract the solar IR (front & back)



5
Electrical setup of the data logger:

1. NanoTimer SparkFun TPL5110,
2. Real Time Clock DS3231,
3. Arduino MKR Wan 1310 PCB
4. LoRa antenna & 5. Sensor connections
6. LiPo Battery & 6'. LiPo rider card



6
Probe housing



7
Sensor cap



8
Data logger housing



9
Top lid

- Encapsulation made of PVC pipe parts:
- Easy to find, cheap and robust material,
 - Electronic components remain accessible,
 - Do not attract attention in the field.

Lab Tests (in sunlight)



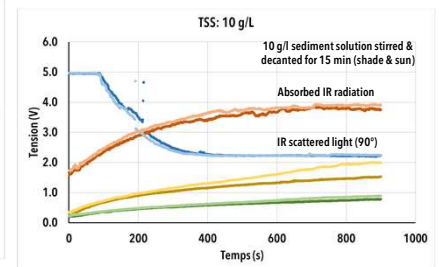
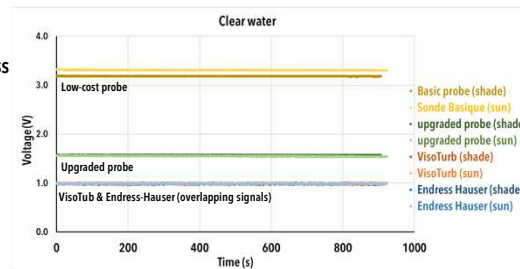
Mobile lab sun-testing unit

Several hours of lab testing on:

- ✓ Electronic operation
- ✓ Encapsulation water-tightness
- ✓ Sunlight impact on probes (basic & upgraded)

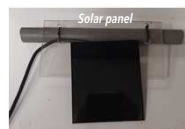
Satisfactory test results,
Narrower sensing range than market probes (lower sensitivity)

Sunlight Impact (Voltage change over time)



Field tests in Chassieu town (69) Lyon East

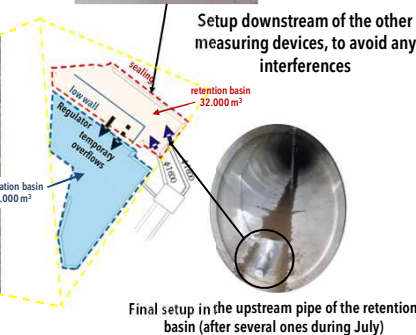
- Solar panel power supply for stand-alone probe
- Control of the turbidity sensor power supply (lock-in detection)



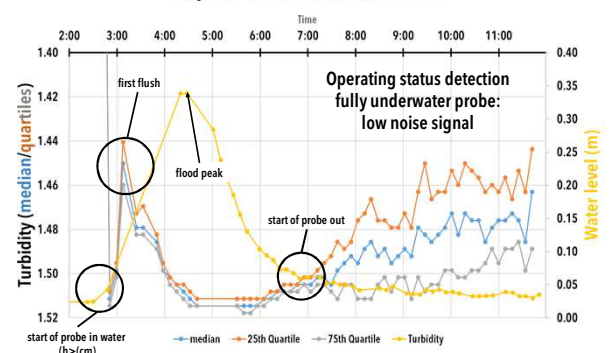
- 5 min standby scheduled between two measurements
- Data transfer via LoRaWAN protocol
- OpenDataEau platform for sharing data



Storm-water runoffs from the Chassieu's industrial zone



July 28, 2021 thunderstorm event



Conclusions

Remote monitoring system built for a total cost ≈ 200 € HT
Data transfer via LoRaWAN protocol to
OpenDataEau platform for sharing data
Suitable for any low-power sensor

