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The SETIER project: An open source flowmeter for monitoring flow rates of wastewater treatment plants

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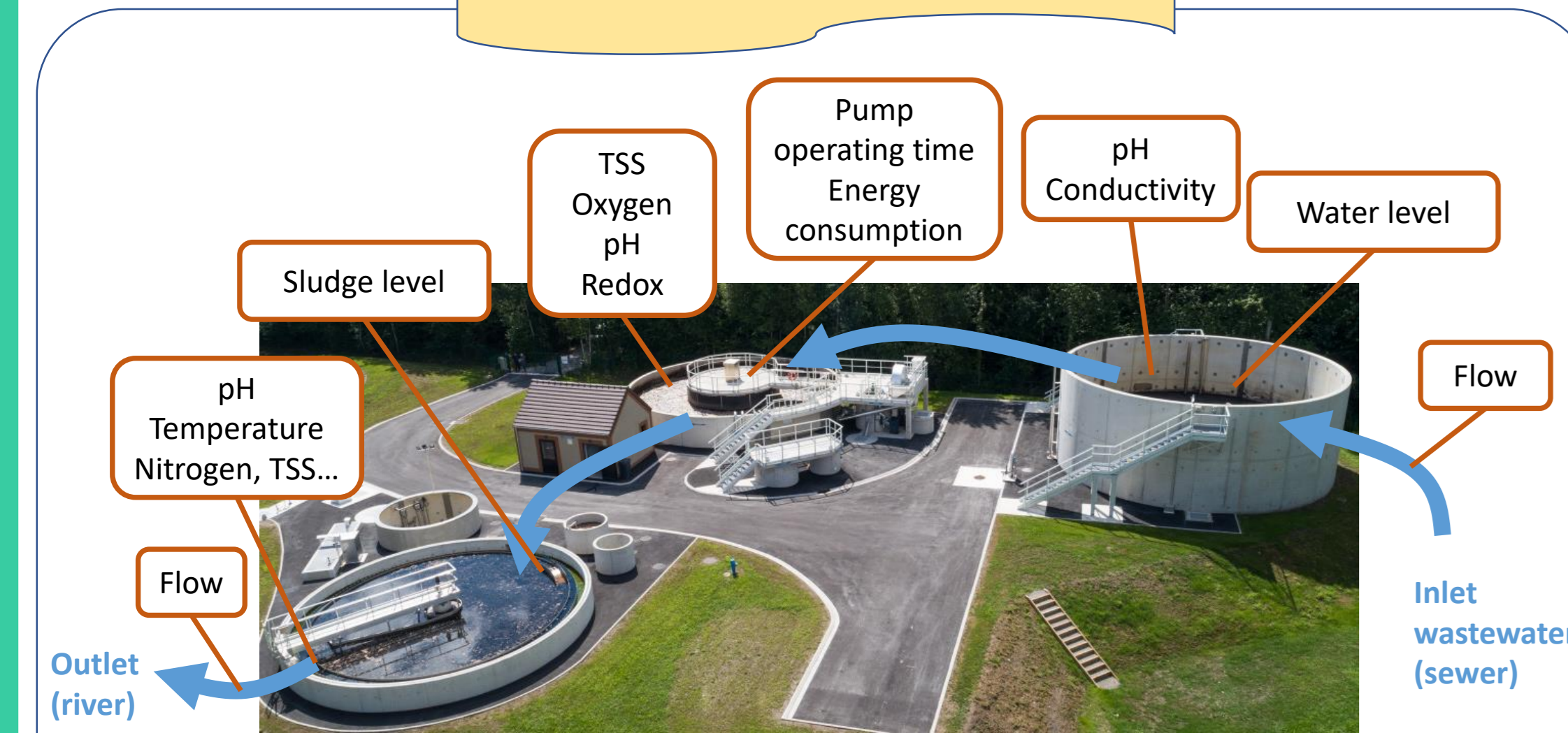


The SETIER project: An open source flowmeter for monitoring flow rates of wastewater treatment plants

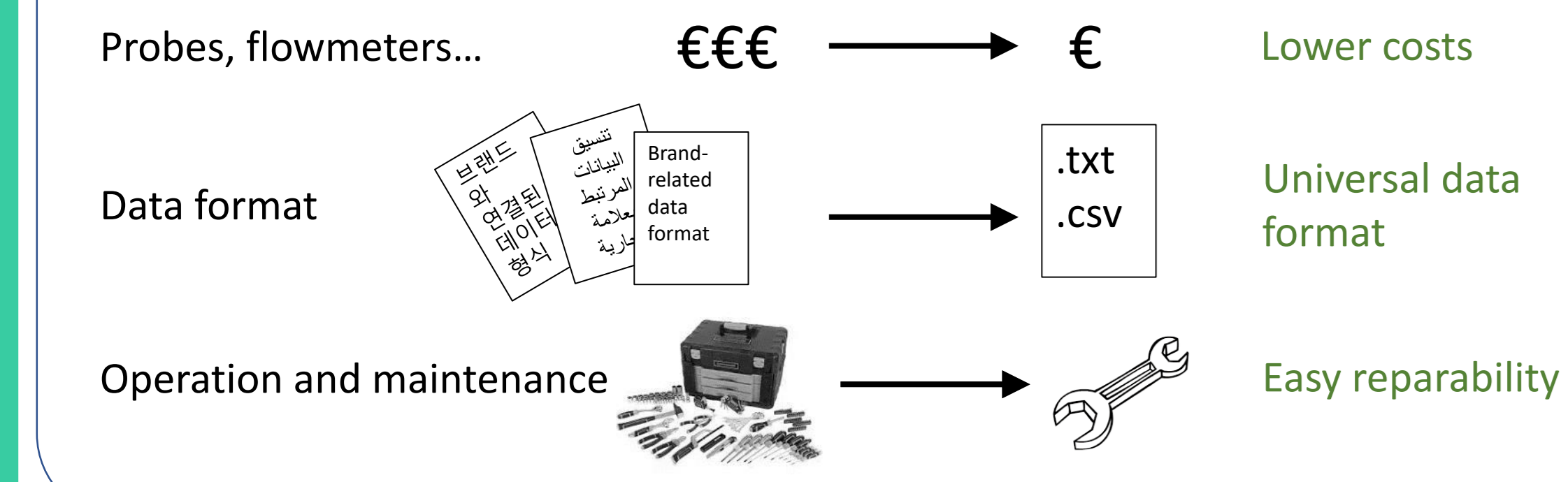
Abstract



Context



Is this possible with open source material?



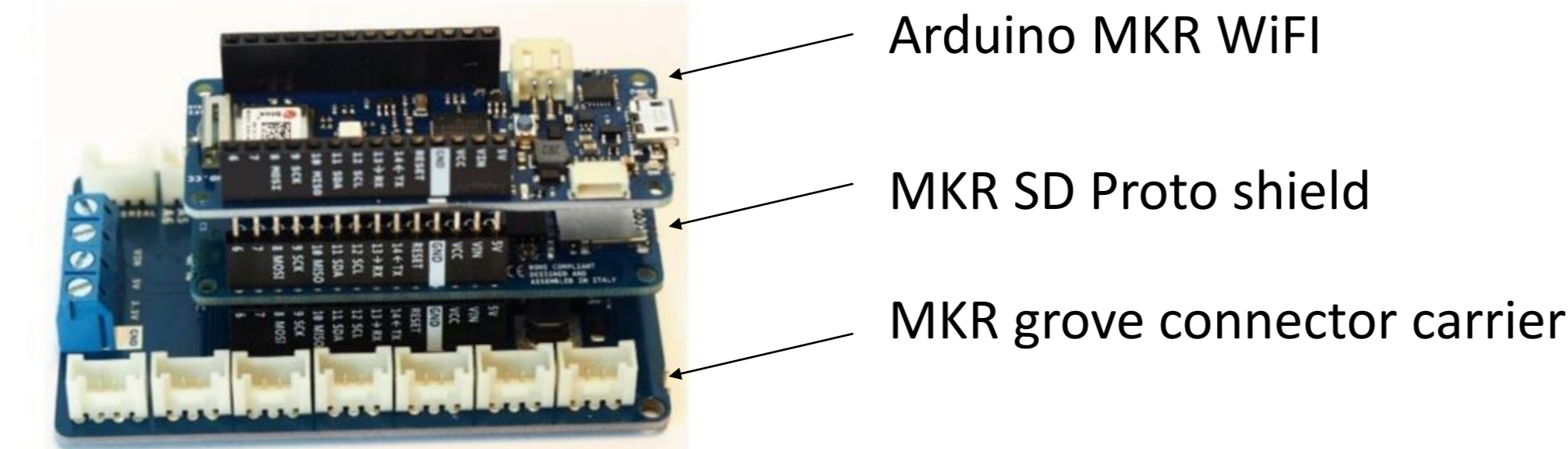
Objectives

- The SETIER project aimed to develop "low tech" devices for wastewater treatment plants monitoring:
- Identify the key parameters (physico-chemical, energy, flow...)
 - Identify and qualify sensors according to the operator's needs
 - Obtain feedback and validate the selected sensors: metrological approach (laboratory, pilot, field)
 - Propose the simplest possible sensor/acquisition unit design, autonomous and including remote data transmission
 - Propose guidelines for the assembly of units & sensors (no soldering)

Achievement

Physico-chemical	Energy	Water level
Specification for physico-chemical datalogger	Specification for energy datalogger	Specification for water level datalogger
Approximate price : about 700 €	Approximate price : about 400 €	Approximate price : about 300 €
Assembling difficulty : [Progress bar]	Assembling difficulty : [Progress bar]	Assembling difficulty : [Progress bar]
Assembling time : 1 day	Assembling time : 0.5-day	Assembling time : 0.5-day
data acquisition rate : 15 min; 30 min; 1 hour; 1 day	data acquisition rate : 1 min; 15 min; 30 min; 1 hour; 1 day	data acquisition rate : 1 min; 15 min; 30 min; 1 hour; 1 day
pH range : 0 to 14 pH units	Range 1 : 0 to 5 Amp	Range : 10 to 150 cm
ORP range : -2000 to 2000 mV	Range 2 : 0 to 10 Amp	Power supply : 12V DC
Dissolved O2 range : 0 to 20 mg/L	Range 3 : 0 to 10 Amp	Autonomy : 1 Month on 12V/50Ah battery, data rate 1 min
EC range : 0 to 15 mS/cm ²	Power supply : 12V DC	Data storage : µSD card
Power supply : 12V DC	Autonomy : 3 weeks on 12V/50Ah battery, data rate 15 min	
Data storage : µSD card	Data storage : µSD card	

Heart of the acquisition unit



Same hardware for all the datalogger in the achievement

Voltage divider to measure the power supply

LED to advise :

- measurement in progress
- if WiFi is on

Connector for push button to enable WiFi

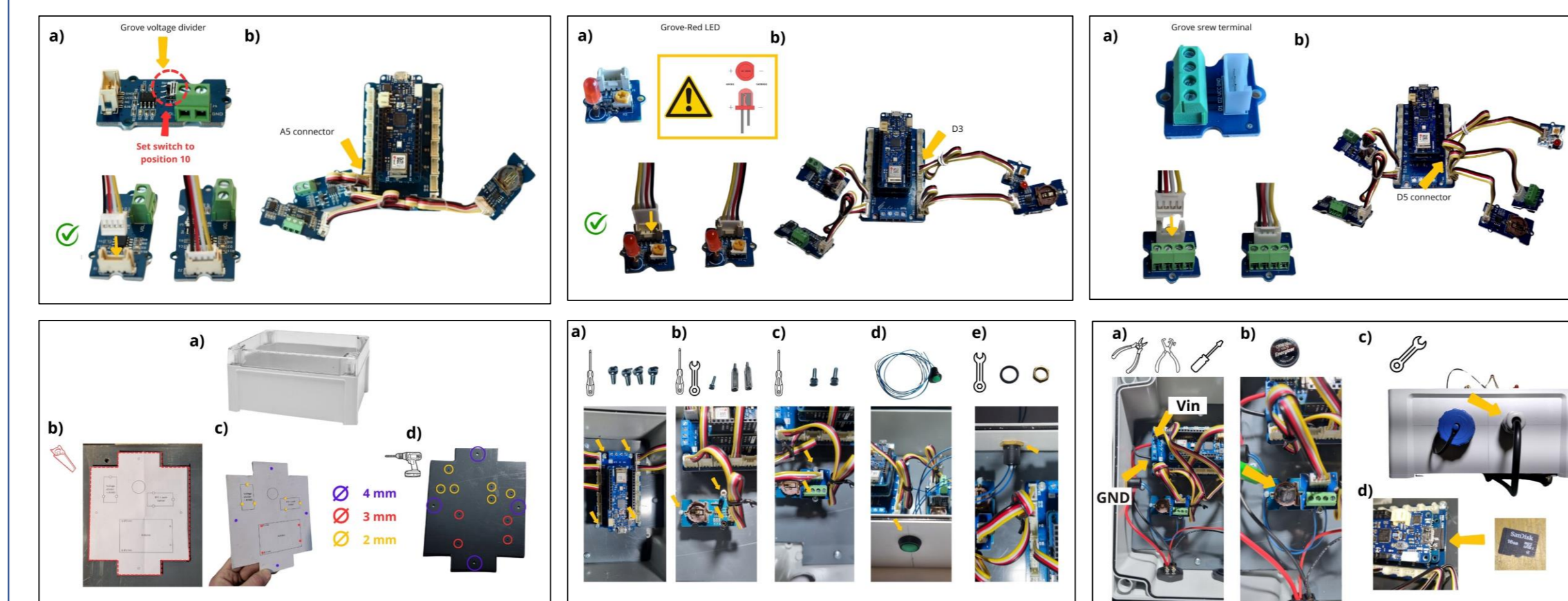
Serial port converter for ultrasonic sensor RS485 to UART

RTC (Real Time Clock)

Assembling guidelines (DIY)

- Component list
- Step by step assembling description
- No soldering
- Arduino software
- All explanations for configuration
- All explanations for data collection

Repository : https://gitlab.irstea.fr/reversaal/setier_datalogger



One software for all the datalogger in the achievement

Training and Assembling times could be long depending on skills
→ Low tech is relevant when you have to implement several units !



WiFi data collection



- SETIER datalogger integrates web server
- Nearby own generated WiFi
- Website available on IP 192.168.4.1
- Universal data format .txt « ; » separator
- Logging record for each connection
- Access with smartphone or pad & PC
- WiFi auto stop

Sensor validation

Validation was made on an open flum with comparison to a reference measurement technic (bubble to bubble: "Bubble flow 2").

Principle of Bubble flow 2:

- Air pressure measurement necessary to extract a bubble from a submerged end of pipe.
- Gives the water high over the end of the pipe.

open flum

Specification	SEN0358
Operating Voltage	DC 7-15V
Max Instantaneous Current	350mA
Effective Measuring Range	100-1500mm
Distance Resolution	0.1mm
Measuring Accuracy	1mm
Distance Error	±0.1%
Temperature Resolution	0.1°C
Temperature Error	±1°C
Measuring Frequency	30Hz
Operating Temperature	-20°C ~ +80°C
Sensor Acoustic Frequency	200KHz±4%
Directional Angle	12°±2°(-6dB)
Protection Grade	IP65
Communication interface	RS485

- Similar results
- Less than 3% error
- Standard error 0,6 mm

! TRY ME !

Generates nearby WiFi with webservice

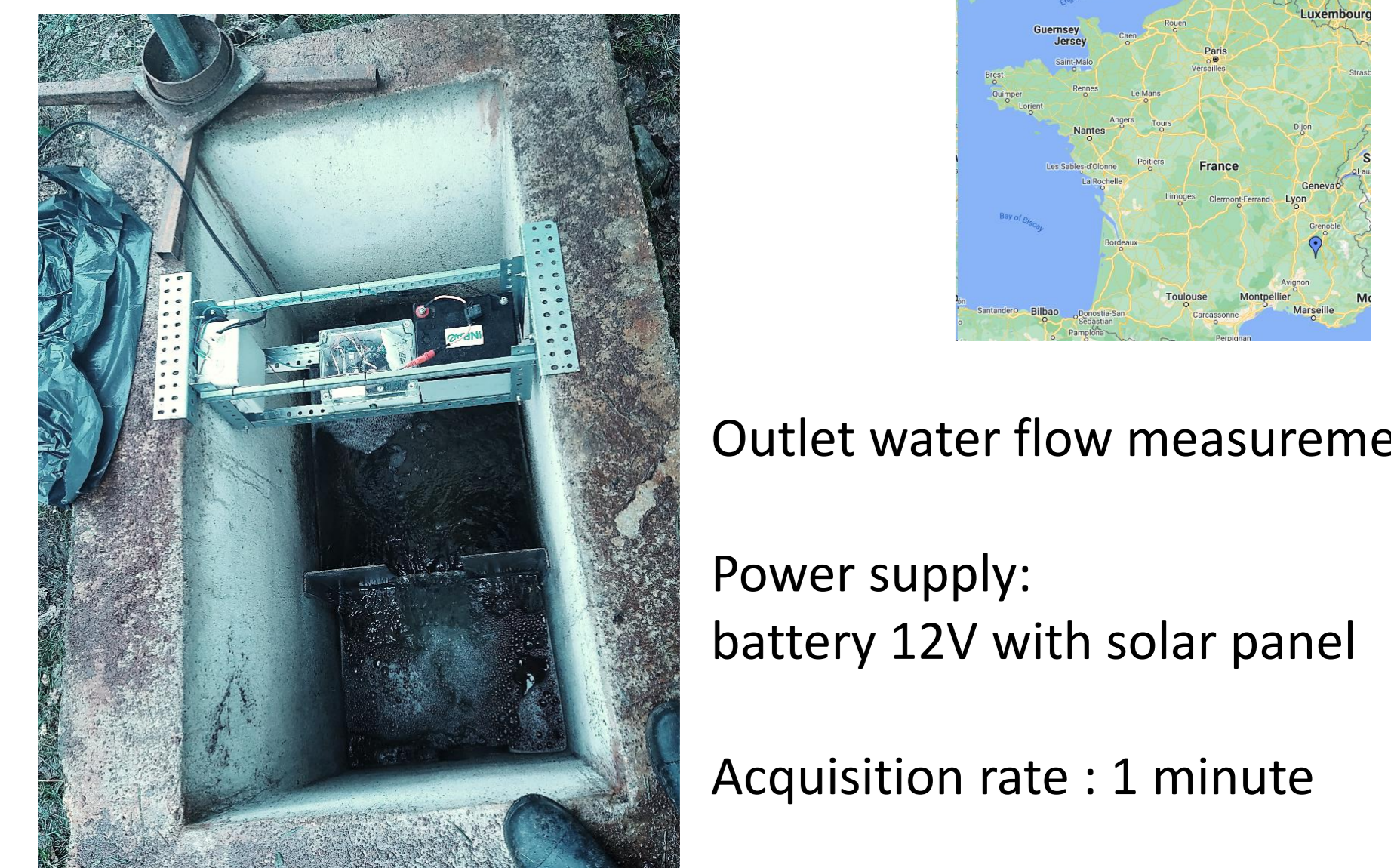
- Measurement function
- Data collection or suppression
- Logging file collection or suppression

192.168.4.2

Try! One by one please!

Field tests

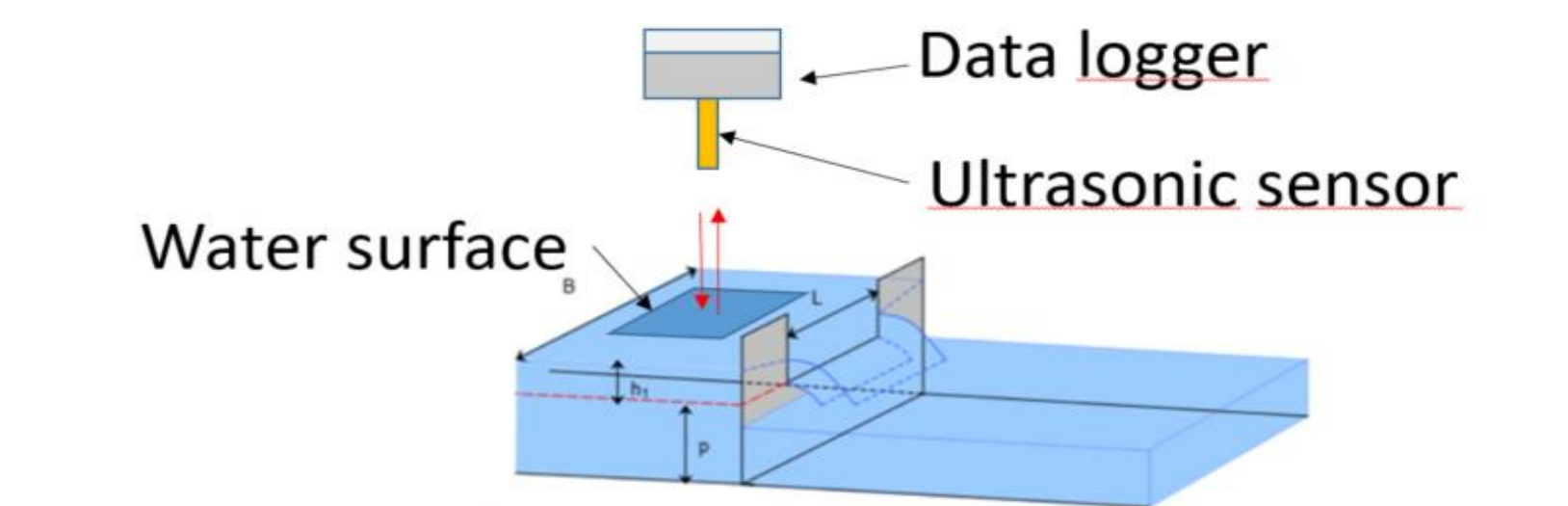
Wastewater treatment plant process: reeds bed filters
Location: Luc-en-Diois (France)



Outlet water flow measurement

Power supply: battery 12V with solar panel

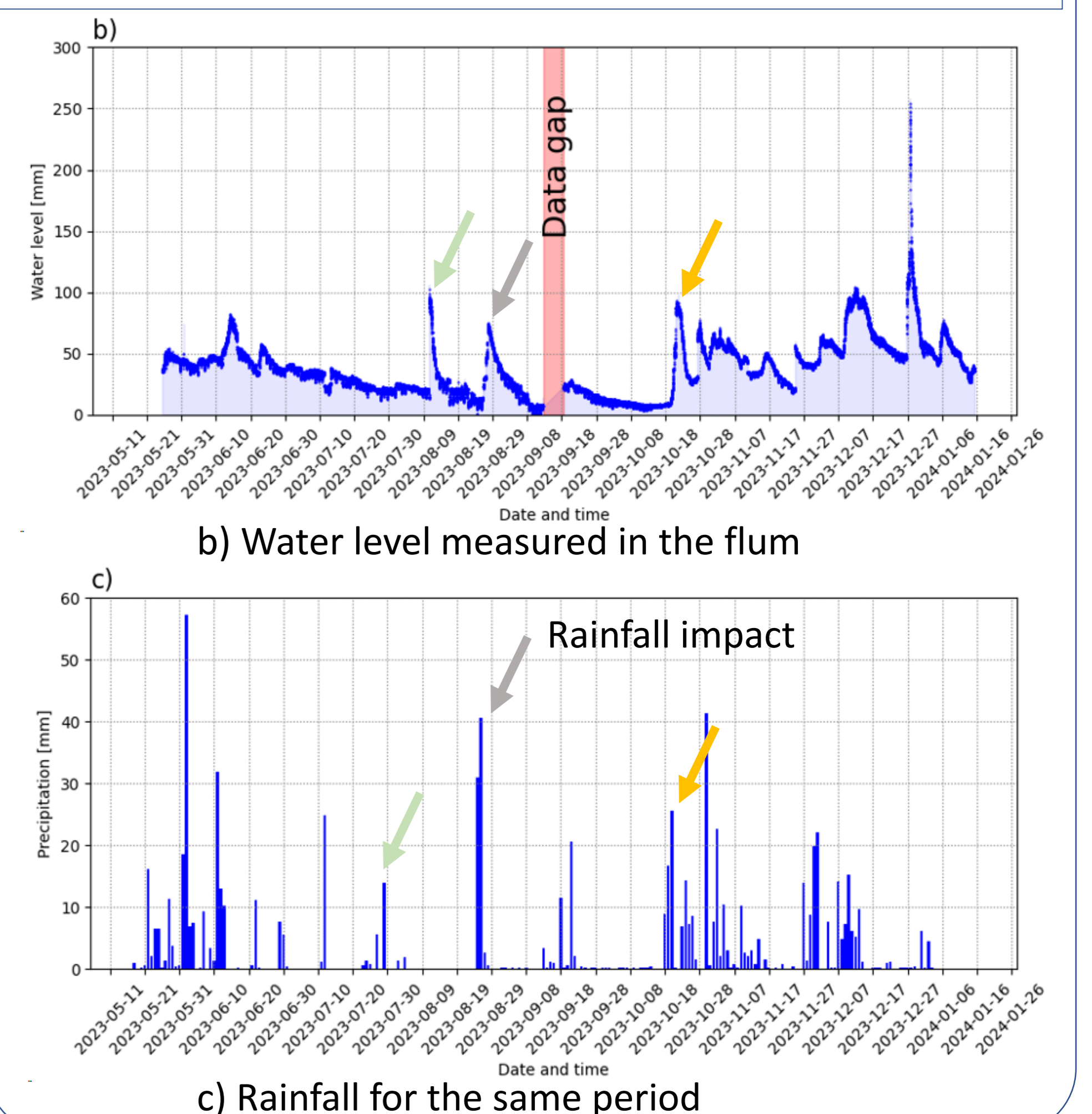
Acquisition rate : 1 minute



Perspective view of a rectangular spillway

Flow = f(water level)

Period: May 2023 to January 2024



Acknowledgment

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