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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



Context

Is this possible with open source material?

- Probes, flowmeters... €€€ → € Lower costs
- Data format: Brand-related data format → .txt, .csv Universal data format
- Operation and maintenance: → Easy reparability

Heart of the acquisition unit

- Arduino MKR WiFi
- MKR SD Proto shield
- MKR grove connector carrier

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)

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

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

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)

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

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 an submerged end of pipe.
 - Gives the water high over the end of the pipe.

$P = \text{flum depth}$
 $H = \text{water level}$

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

Period: May 2023 to January 2024

b) Water level measured in the flum

c) Rainfall for the same period

Achievement

Physico-chemical

Specification for physico-chemical datalogger	
Approximate price :	about 700 €
Assembling difficulty :	1 day
Assembling time :	15 min ; 30 min ; 1 hour ; 1 day
data acquisition rate :	0 to 14 pH units
pH range :	0 to 14 pH units
ORP range :	-2000 to 2000 mV
Dissolved O2 range :	0 to 20 mg/L
EC range :	0 to 15 mS/cm²
Power supply :	12V DC
Autonomy :	3 weeks on 12V/50Ah battery, data rate 15 min
Data storage :	µSD card

Energy

Specification for energy datalogger	
Approximate price :	about 400 €
Assembling difficulty :	0.5-day
Assembling time :	1 min ; 15 min ; 30 min
data acquisition rate :	1 hour ; 1 day
Range 1 :	0 to 5 Amp
Range 2 :	0 to 10 Amp
Range 3 :	0 to 10 Amp
Power supply :	12V DC
Autonomy :	1 Month on 12V/50Ah battery, data rate 1 min
Data storage :	µSD card

Water level

Specification for water level datalogger	
Approximate price :	about 300 €
Assembling difficulty :	0.5-day
Assembling time :	1 min ; 15 min ; 30 min
data acquisition rate :	1 hour ; 1 day
Range :	10 to 150 cm
Power supply :	12V DC
Autonomy :	1 Month on 12V/50Ah battery, data rate 1 min
Data storage :	µSD card

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 !

! FLASH ME !

! 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!

Acknowledgment

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