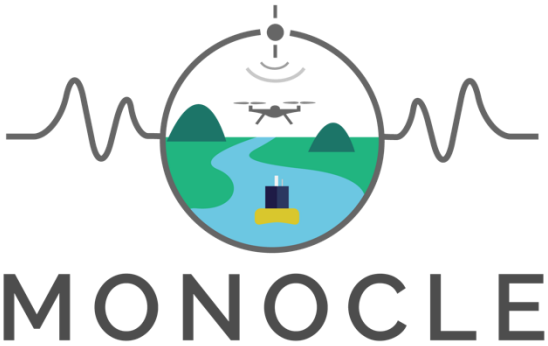
Project	MONOCLE H2020 (grant 776480)	**Start / Duration**	1 February 2018/ 48 Months
Dissemination	PUBLIC	**Nature**	OTHER
Date	29 November 2019	**Version**	1.0



Multiscale Observation Networks for Optical monitoring of Coastal waters, Lakes and Estuaries

Deliverable 2.4

Legacy sensor interface including software library and user interface

Project Description

Funded by EU H2020 MONOCLE **creates sustainable *in situ* observation solutions for Earth Observation (EO) of optical water quality in inland and transitional waters.** MONOCLE develops essential research and technology to lower the cost of acquisition, maintenance, and regular deployment of *in situ* sensors related to optical water quality. The MONOCLE sensor system includes handheld devices, smartphone applications, and piloted and autonomous drones, as well as automated observation systems for e.g. buoys and shipborne operation. The sensors are networked to establish interactive links between operational Earth Observation (EO) and essential environmental monitoring in inland and transitional water bodies, which are particularly vulnerable to environmental change.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776480

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Document History:

Release	Date	Reason for Change	Status	Distribution
0.9		First draft for internal review	Draft	Internal
1.0		First release	Final	Public

To cite this document:

Simis, SGH, Kershaw Brown, J, Snee, D. (2019). D2.4 Legacy sensor interface including software library and user interface. *Deliverable report of project H2020 MONOCLE (grant 776480)*. DOI: 10.5281/zenodo.3558533

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TABLE OF CONTENTS

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1. Executive Summary

A hardware and software interface was developed to connect legacy sensors to the MONOCLE network. The interface interprets data streams from sensors and converts these into an interoperable format coupled with geolocation information. A number of sensor types and specific functionality to control these have already been implemented, whereas the software can be modified to include others. This is an open hardware/software concept (see License section) for which external development is encouraged.

2. Scope

This document describes the concept of the legacy sensor interface and provides an overview of where the latest software version and documentation are found. Prospective users will be able to find all required resources from the descriptions given in this document, and understand the general principles of operation.

3. Concept

A legacy sensor interface was created to make existing sensors compatible with the MONOCLE backend and metadata requirements. Many existing sensors do not have the functionality to identify themselves or provide unique observation identifiers and metadata on data ownership and licensing. Furthermore, legacy sensors will often not be able to connect to internet servers in real time due to lacking connectivity options. The MONOCLE legacy software interface, or **SOS-box** in short, provides:

- Ethernet connectivity for local or remote monitoring
- A WiFi interface for configuration by operators and local monitoring
- Data models to map known sensor outputs to structured data
- Local storage in a database (i.e. data logging functionality)
- Data interoperability through the Open Geospatial Consortium (OGC) Sensor Observation Service (SOS) standard, allowing data to be transmitted to a receiving SOS server.

Typical usage scenarios would be where scientists currently use data loggers to record observations from in-situ sensors such as fluorometers and radiometers. The SOS-box software will collect the data being read by the sensor and then store it locally, and once in range of signal will send the data to the remote server SOS.

At present, support is already implemented for Wetlabs BB, BB3 and BB9 sensors, GNSS/GPS (NMEA) and UBlox7 GNSS protocols. Other sensor configurations are being added.

A strict requirement for the sensor interface is to not consume much power while still providing multiple interfaces for operators and remote operation. The SOS-box has been developed for the Raspberry Pi zero platform, which can run autonomously on battery power for long periods of time, and provides serial and Ethernet (through adaptor cables) and a WiFi interface. The typical cost of a Raspberry Pi zero is around €11. Depending on further interfaces and enclosures that are needed, the typical cost of the complete solution will be in the range of €30.

4. License

The software underpinning the legacy sensor interface is licensed under the GNU Lesser General Public License. This license also covers all included software dependencies, as listed in Table 1.

Table 1 Software libraries on which the sensor interface depends, and their respective licenses

Library	License
Bootstrap.min.css	MIT
Bootstrap.min.js	MIT
Jquery-3.4.1.js	MIT
JS Popper.min.js	MIT
Flask	DSD License (BSD-3-Clause)
Pyudev	GNU Lesser General Public License
Serial	Copyright (c) 2001-2015
Psutil	BSD 3-Clause “New” or “Revised” License

Logging	MIT License, Copyright (c) 2017
re/regex	License OSI Approved Python Software Foundation License
Requests	License OSI Approved Apache Software License

5. Getting started

The legacy software interface is a software package which was designed to run on a low cost Linux-based hardware platform.

The software is hosted in the MONOCLE GitHub repository at the following URL:

https://github.com/monocle-h2020/sosbox/

Where documentation can be found in the 'User guides' folder:

https://github.com/monocle-h2020/sosbox/tree/master/user_guides

The Operating Guide provides the following instructions:

- Hardware requirements
- Hardware setup
- Software installation
- Connecting Sensors

The direct link to the handbook is:

https://github.com/monocle-h2020/sosbox/raw/master/user_guides/SoSbox_Operating_guide_v1.0.pdf

6. Example usage

With a sensor or sensors connected to the interface and initial configuration completed, any data streaming from the sensor will be interpreted according to the available data models. The operator can connect to the interface via WiFi to view the data stream. An example of this interface is shown in **Error! Reference source not found.**.

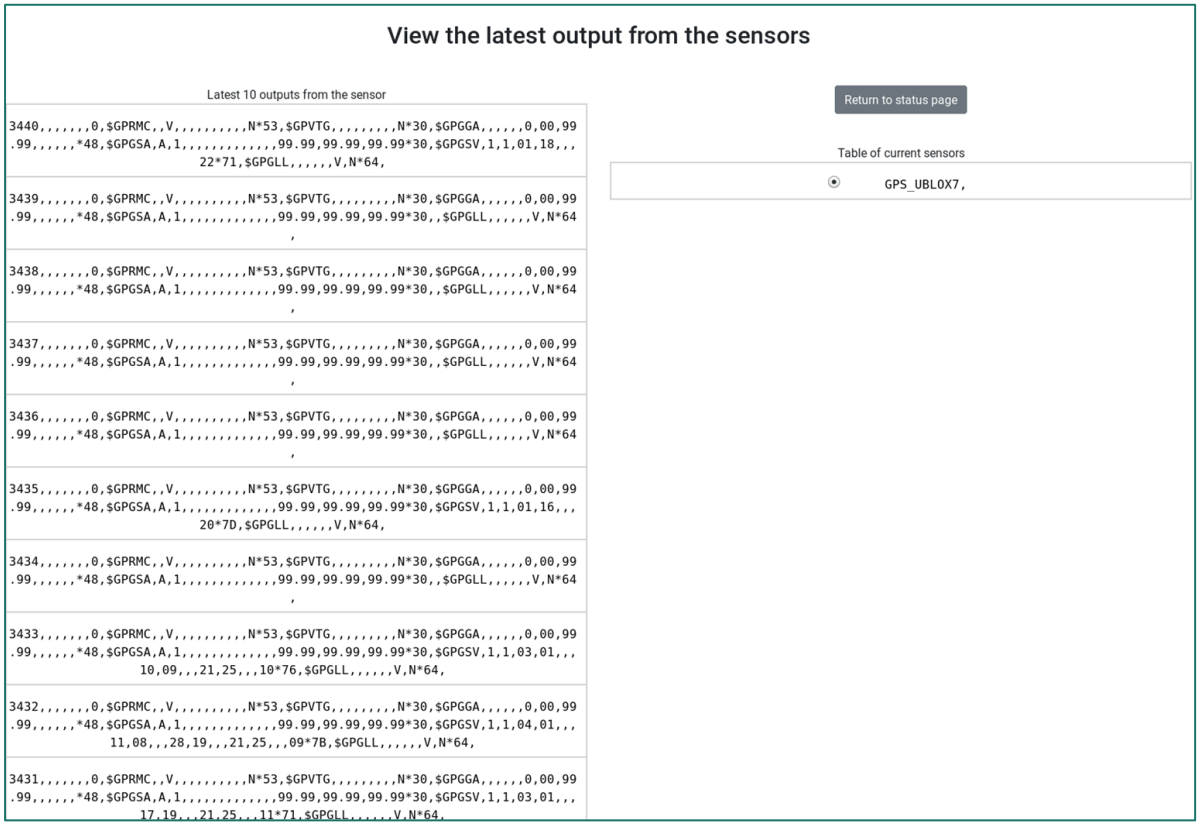

Figure 1. Operator interface

7. Future improvements

A number of further improvements are planned, including:

- Increasing the number of sensors and protocols the software can recognize and support
- Add a feature to combine GPS input with sensors readings while recording data
- A weather-proof enclosure
- A disk image with pre-loaded software and configurations