

# Abstract

This thesis proposes the design of an instrument that measures air quality onboard merchant marine vessels. The device must fulfil the following boundary conditions: (1) be able to measure sulphur oxides, nitrogen oxides, carbon oxides, ozone, particulate matter, temperature and humidity, (2) the air supply to the sensors must go through the tubing and a pump to facilitate calibration in a later stage, (3) the instrument must be (water)tight, and (4) the instrument must be transportable.

The realization of the measuring device begins with an individual study of potential sensors. After the selection of the necessary sensors, the electronic connections have been studied, the required connectors were purchased, and the software to operate and collect data through a central computer written. Writing and installing the software on the central computer requires creating a development environment on an additional stand-alone computer. This step is studied for each sensor on a case-by-case basis. Finally, a dedicated software program synchronizes and groups the data in a shared database when all the sensors are operational. Continuously, upgrades were made, including a printed circuit board that simplifies the electric cables.

Finally, all the components of the measuring device are installed in a watertight Pelican Storm Case to form a single transportable unit. The suitcase is fitted with three aluminium plates, on which selected components are attached (e.g., pump, pipes, transformer, central unit, USB socket).

During the building process of the portable and watertight measuring device, several problems have been encountered: it is hard to find the correct component in the vast amount of possibilities on the market, the selected components are not always compatible with each other, the documentation of sensors is not always clear, errors can quickly occur with software and wires. This dissertation provides lists of components, wiring schematics, software flowcharts, and Python code examples that can be reproduced when someone wants to build a similar device.