**Air Quality Index Calculation for Aerosense**

**Introduction:**

This document provides an in-depth explanation of how raw sensor measurements are converted into the Air Quality Index (AQI) for our air quality monitor band. We also detail the translation of this AQI into a user-friendly percentage, specific to Ireland's air quality standards. Insights gotten from <https://ecmwf-projects.github.io/copernicus-training-cams/proc-aq-index.html>

**1. Particulate Matter Measurements:**

**Sensor Utilized**: PMS7003

**Measurements Captured**:

* PM0.3
* PM1
* PM2.5
* PM10

There's no standard AQI calculation for PM1 and PM0.3, but we can provide how we will work with the PM2.5 and PM10.

* **PM10 AQI Conversion**:
  + **Good (0-50 AQI)**: 0-20 µg/m^3
  + **Fair (51-100 AQI)**: 20-40 µg/m^3
  + **Poor (101-150 AQI)**: 40-50 µg/m^3
  + **Very Poor (>150 AQI)**: >50 µg/m^3
* **PM2.5 AQI Conversion**:
  + **Good (0-50 AQI)**: 0-10 µg/m^3
  + **Fair (51-100 AQI)**: 10-20 µg/m^3
  + **Poor (101-150 AQI)**: 20-25 µg/m^3
  + **Very Poor (>150 AQI)**: >25 µg/m^3

**2. Volatile Organic Compounds (VOC) Measurements:**

**Sensor Utilized**: BME680

For VOCs, the AQI conversion will be based on ppb concentrations.

* **VOC AQI Conversion**:
  + **Good (0-50 AQI)**: 0-200 ppb
  + **Fair (51-100 AQI)**: 200-500 ppb
  + **Poor (101-150 AQI)**: 500-1000 ppb
  + **Very Poor (>150 AQI)**: >1000 ppb

**3. Determining Overall AQI:**

Getting a formula that considers all measurement was a bit challenging. The method chosen for this project is to select the highest AQI value among the measurements. This approach ensures that if any pollutant is at a hazardous level, users will be alerted ensuring the health and safety of our users.

**4. Conversion to Air Quality Percentage:**

To enhance understanding to users, the AQI is further converted into a percentage format. The formula applied is: Air Quality Percentage=(1−AQI/500)×100.

* + **Good 80-100%**
  + **Fair 65-79%**
  + **Poor <65%**

This format ensures that higher percentages correspond to better air quality, making it easier for users to understand.

**5. Practical Example:**

Suppose these sensor outputs:

* PM10: 12 µg/m^3 (**Good**)
* PM2.5: 18 µg/m^3 (**Moderate**)
* VOC: 180 ppb (**Good**)

From our AQI Standards:

* PM10 falls within the **Good** range (0-50 AQI)
* PM2.5 is categorized as **Moderate** (51-100 AQI)
* VOC is rated **Good** (0-50 AQI)

With our method, the highest AQI is taken, which is **Moderate** from the PM2.5 reading. Translated to our percentage formula, this yields an air quality score of roughly **75%**, indicating **Moderate Air Quality**. This way we can cater for the worst case scenario.