The Project

The ASPIDI project, in responding to the need of the Apulian Water Authority to have real-time monitoring and control systems of the odorous emissions deriving from the purification plants, intends to develop a prototype of a trained electronic nose capable of detecting unpleasant odors and sending the real-time signal to a database that will update a web-gis platform that is easy to access by citizens.

The Technology

The Sensigent MSEM™ 3200 IOMS multi-sensor system (Sensigent LLC, Baldwin Park, CA) for the ASPIDI project, employs an array of 32 sensors, developed with diversified technology (NCA, MOS, PID, EC).

The different types of sensors used in the array ensure a high discriminating power in instrumental responses and in the ability to recognize odorous traces. Furthermore, the large number and the presence of redundant sensors ensure greater stability and accuracy in the return of instrumental outputs. The Sensigent MSEM™ 3200 IOMS E-Nose System works in online prediction mode, i.e. it returns a response in terms of Instrumental Odors Units and in online pattern recognition mode.

The output parameter of odor units and ID (type of odor) is calculated in real time by a machine-learning algorithm with ad-hoc optimized algorithms, which take into account the response variations of the various sensors, and associate to each of them a correlation factor extrapolated automatically and from time to time from the training procedure according to UNI EN 13725.

The high technological level used in the construction of the sensors is highlighted by the reduced instrumental response times and the potential for selective training on the investigated source and finally by a good accuracy in the pattern-recognition methods even at low concentrations of odorous compounds.

The system has a dashboard for displaying monitoring and control data and can include the presence of a weather station whose parameters are automatically displayed and saved together with all the sensor parameters.

The training phase consists in taking two reference samples from different types of emission sources, in analyzing them according to UNI EN 13725 and finally in administering them respectively to the measuring instrument as they are or diluted.

When the training phase is optimal, the system is able for that specific type of odor to assign a value of instrumental odor units with high accuracy in line with the analytical data of the olfactometric tests. The Sensigent MSEM™ 3200 IOMS monitoring system is interfaced with a sampling system compliant with UNI EN 13725 that can be activated automatically and remotely (OdorPrep).

During the validation phases, when the threshold parameters set on the E-nose system are exceeded, the sampling system will automatically activate, taking samples of ambient air, which in turn will be subjected to an olfactometric investigation according to the standardized UNI EN 13725 methodology The odor concentration value expressed in odor units from the olfactometric survey will be compared from time to time with the instrumental odor units detected by the electronic device.

Finally, the OdorPrep system can be activated in parallel by the dedicated platform for managing odor nuisance reports. The receptors, using free signaling Apps, can report the olfactory discomfort at any time with the relative level of perceived intensity. Reports will be digitally archived and processed in terms of number, time, reported intensity and gps coordinates.

Depending on the number of reports received, the OdorPrep system installed at the border of the plant will automatically take action by taking samples of ambient air, which in a similar way will be subjected to an olfactometric investigation according to UNI EN 13725. Also in this case, the odor concentration value expressed in odor units returned by the standardized methodology will be compared from time to time with the instrumental odor units detected by the electronic device.

For more information on the ASPIDI project: https://www.progettoaspidi.com/aspidi/tecnologia/

For more information on the MSEM™ 3200 IOMS instrument: https://www.sensigent.com/msem.html

Cangialosi, F.; Bruno, E.; De Santis, G. Application of Machine Learning for Fenceline Monitoring of Odor Classes and Concentrations at a Wastewater Treatment Plant. Sensors 2021, 21, 4716.