Dynamic Visualization of Real Data for 3D Odor Plume Mapping

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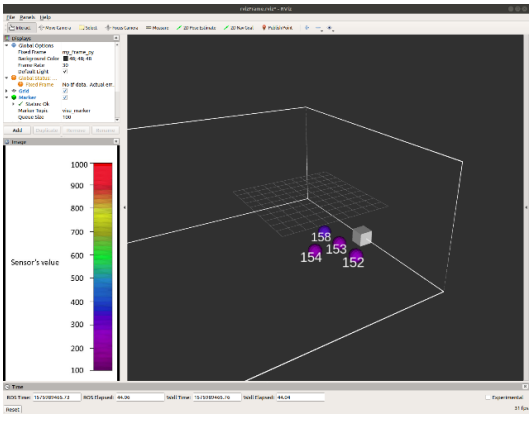
Odor distribution mapping is a very useful tool and finds application in environmental monitoring to help humans in dangerous situations such as detection of gas leaks, toxic chemical dispersions and environmental emergencies.

The goal of this project was to create a 3D spatial dynamic odor map with the aim of visualizing data in real time and being able to record data sets during experiments for later analysis. This visualization needed to be compatible with the multiple platforms researchers are using, namely ground robots and quadcopters. Therefore, it was decided to implement the visualization using ROS (Robot Operating System).

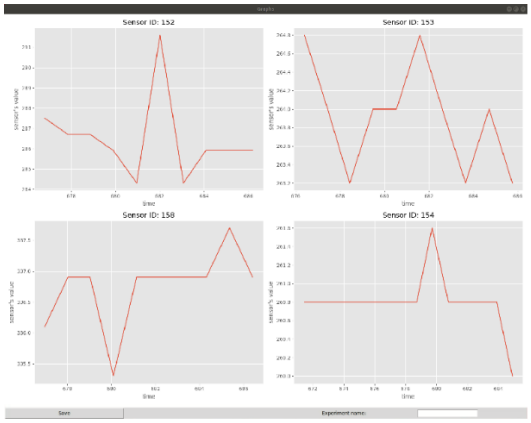
Wireless sensor nodes developed by researchers at DISAL were used to test the data visualization strategy. Sensor data is sent to the server via WIFI. In a previous implementation of a 2D temporal visualization, data was retrieved from the server with Flask web framework and displayed in a web page. In this project, data was retrieved similarly before being sent to ROS in order to be displayed.



3D spatial visualization in RViz

The 3D spatial visualization was created using RViz. Nodes positions and values are sent to RViz. Each sensor node is represented with a sphere next to which is indicated the sensor ID. The color of the sphere changes with the corresponding sensor value according to a color gradient created in RViz. The experiment room is also shown in order to make the visualization clearer. Since wireless nodes do not have self-localization capabilities, position coordinates were manually inputted in the code. For future experiments with self-localization possibilities, coordinates can also be retrieved with a localization system compatible with ROS such as Motion Capture System.

A window with embedded matplotlib graphs was created using tkinter in order to display the 2D temporal visualization. Each sensor is represented by its own graphs in which sensor values are displayed as a function of time. In order to keep a clear visualization, only the last 10 seconds are displayed.



2D temporal visualization.

A feature to save data was integrated in the project. For this purpose, a save button is displayed in the tkinter window. For each sensor, a csv file is created in which the sensor values, time and position coordinates are written. All csv files are then stored in a zip folder. The name of the folder is chosen by the user and the epoch time is added to ensure that every folder has a different name in order to avoid overwriting.