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Influence of Appliance Types in Relation to VOC Emissions

Air quality data is often collected for a variety of reasons. It can be collected in the name of human health, pollution, agriculture or even an overlapping area that includes all of these. Since many of these components that are found in the air are invisible to the human eye, it is often easy to forget about them and disregard their influence on our daily lives. But with the help of ecological sensors, typically attached to a Raspberry Pi computer, we are able to detect those things that are unable to be seen with the naked eye. The collection of this type of data and the thorough analysis of it after collection can work to improve human health and living conditions, especially in large urban areas.

We examined a data set that was collected and compiled by a previous class back in 2020. The sensors that were used detected many different qualities found within the atmosphere, including the volatile organic compounds and 2.5 µm particulates. Volatile organic compounds, or VOCs, have a high vapor pressure and low water solubility, which allows them to persist in the environment after long periods of time. They pose a risk to human health and can have both short-term and long-term effects. They are most commonly found in the environment from pesticides, cleaning products, paints, pharmaceuticals and refrigerants. Although it is already known from previous research that VOC levels are typically higher indoors, we tested whether there was an observable difference between the type of stove found within a household.

To do this, we deployed sensors in multiple types of places, including indoors and outdoors. The indoor sensors were placed as a control since we wanted to test the change between indoor sensors. The sensors that we decided to place included the Seeed Studio Grove Air Quality Sensor v1.3, which is a metal-oxide sensor. Additionally, the sensor also contained a Shinyei PPD42 Dust Sensor and BME280 Temperature and Humidity Sensor, which measures the 2.5 µm particulates, temperature, and humidity. These factors can influence the metal oxide measurements and are gathered for quality control.

According to these results, there is a difference between the appliances used in a household and the VOC emissions that are recorded. As shown in Figure 1, we took the averages from gas stoves, electric stoves, and sensors placed outside to see these differences. From the figure, it is evident that electric stoves produce more VOCs than gas stoves.

Using this information, we can make multiple inferences about the air quality of an area and the best course of action for the future. If we completed a census of a population, we would be able to determine an average of the amounts of VOCs present in an urban population. Additionally, we can recommend the use of gas stoves in more populated areas to reduce the number of VOCs that humans may come into contact with, as urban areas are more inclined to have a higher level of VOCs. Finally, to reduce the overall number of VOCs emitted, we could propose a change from electric to gas stoves to reduce this number.

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**Figure 1**: A bar graph showing the VOC emission rates between electric stoves and gas stoves compared to the average emission rates from sensors places outside.

Works Cited

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