Name(s)
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Project Number
J1118

Project Title
Aerification: Sensors to Improve Indoor Air Quality with an Intelligent Ventilation Guidance System

Abstract

Objectives/Goals
Clean air is vital for a healthy body and a healthy mind. We spend much of our time indoors breathing poorly ventilated/polluted air. My goal was to create an intelligent ventilation guidance system, which took input from my indoor air quality sensors and integrated them with the nationwide, airnow.gov outdoor air quality data. I created a Raspberry Pi based sensor system, that measures particulate matter PM2.5 and Volatile Organic Compounds for indoor air. I also wrote a program to take the outdoor air quality measurement in real time from the www.airnow.gov. My program then compares these readings and provides real-time guidance on when to ventilate our indoors (homes, schools, offices.etc). For my project, we opened windows around the home to ventilate, and then validated the improvement in indoor air quality using my sensor data.

Methods/Materials
My project includes three primary components - A Raspberry Pi based indoor air quality sensor, A program for real-time API integration with airnow.gov data, and notification system, via text and email. The Raspberry pi sensor system includes a Raspberry Pi, with an Indoor Air Quality sensor, for detecting VOCs and PM2.5, an HCHO Sensor as a semiconductor VOC gas sensor, a temperature-humidity sensor, a dust sensor and a GPS sensor. The real-time integration with airnow.gov is via API calls from my python program, using my unique token for the project. The notification system is set up for continuous monitoring and alerts. When the air quality degrades indoors, the guidance on the current outdoor air quality helps to see if opening the window for ventilation will improve indoor air.

Results
At my home on average, we saw a 52.2% increase in air quality after opening the window for 30mins. The test was repeated, in multiple rooms at different times of day, at my home, school, and library, with results ranging from 47.8% - 58.9% improvement. The airnow.gov data is available as an hourly update. The email and text alerts have been reliable on the guidance for when to open windows.

Conclusions/Discussion
My conclusion is indoor air quality can truly be improved, by intelligent ventilation from outdoor air. A closed loop system such as my project here, that measures and compares indoor and outdoor air, is critical for every future building being built. Besides improving health, researchers have found that better air quality improves cognitive thinking.

Summary Statement
I built an indoor air quality sensor and implemented a real-time integration with airnow.gov nationwide sensor system, such that I could continuously compare indoor and outdoor air quality, and provide intelligent guidance on when ventilati

Help Received
My family helped significantly in procuring all the materials needed to build the sensor system. I used Online resources to learn python programming and how to program grove-pi sensors.