DIY Air Monitoring Education for a Cleaner Environment

The University of North Texas, UNT, and Future Without Poverty, Inc., FWOP, are partnering to provide a series of STEM and Public Health workshops. During a 2 to 3-hour hands-on session we will show students how to build a simple particulate matter (PM) monitor with parts you can buy online and easily connect to a system of monitors in operation around the world (luftdaten). These workshops are designed to engage students in science and engineering topics while educating our community about the environment and public health.

The workshops are structured with a flexible curriculum that can engage students at all levels and provides many avenues to introduce STEM and public health topics. Wherever a workshop is conducted, we will attempt to establish a single monitor and the remaining monitors will be given to the students to install in their communities. Any monitors that are built but not installed will be donated to other areas of the world where significant air quality challenges persist.

The primary goals of these workshops are:

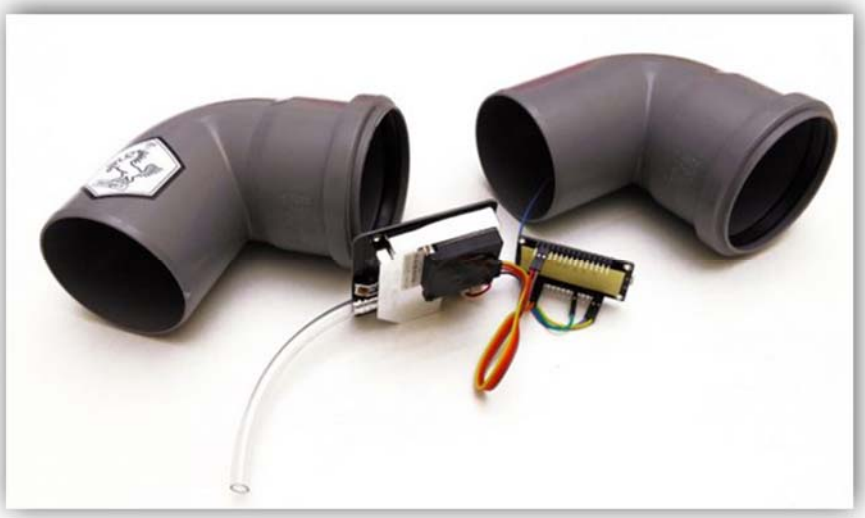
1. Introduce STEM and Public Health topics to underserved and underrepresented communities,
2. Educate the community about the impact of air quality on health and the environment at both local and global scales,
3. Establish a network of PM monitors at home and abroad that will provide both a community alert system and a wealth of data for further research, and
4. Have some fun!

This project will be conducted by Constant Marks, a PhD. student in Mechanical and Energy Engineering at UNT, with the help of two undergraduate students and a high school student. The work will be overseen by Prof. Stan Ingman, a Professor of Applied Gerontology, Editor of Sustainable Communities Review and Vice President of FWOP (www.fwop.org).

Several interested parties including the Dallas ISD, Frisco ISD, and Denton ISD, as well as various youth programs in Nashville and St Louis and the CATIE institute in Costa Rica have already been identified and are eager to bring these workshops to their students. We have also contacted a network of other researchers, civic organizations, and NGOs, who would like to be involved in this project at various capacities. These workshops are the initial phase of larger project that will be proposed for NSF funding in the fall.

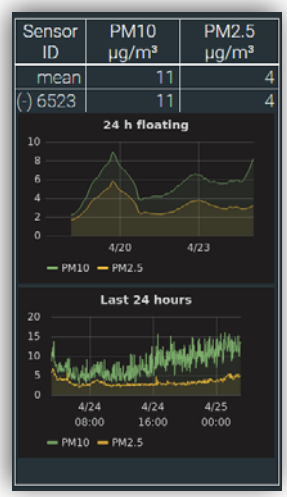
PM Monitor Assembly Outline

The assembly of the PM monitor is designed so that anyone can do it. With only 7 wires and 2 cable ties, the kit becomes a Wi-Fi connected PM monitoring station. A photo of the partially assembled monitor is shown below.



PM Monitoring Station

The parts are sourced from AliExpress and Amazon. A group in Stuttgart (www.lufdaten.info) have programmed the firmware that will be installed on the PM monitors and hosts the servers that store the data. Part of the workshop will include teaching students how to connect and install firmware onto the monitor's microcontroller (NodeMCU) and connecting the devices to the Luftdaten API. The microcontroller is based around the popular Arduino platforms and some of the more advanced modules will include programming in the Arduino IDE.



To assemble the monitors a PM sensor (SDS011) and a temperature and humidity sensor (DHT22) are connected to the NodeMCU. After wiring, the components are secured with cable ties and installed into the housing made from two PVC pipe fittings. Next we configure the stations Wi-Fi, and then the sensor can be 'tested' after about 10 minutes on the lufdaten.info website.

Finally, to make the PM monitors a permanent part of the network, we send some site specific information to lufdaten.info. We will send the students an email with their sensor ID, once the sensor are installed and integrated into the Lufdaten network.