

Indoor Air Quality Gas Sensor Design

IAQ as a right

According to the EU, WHO and EPA, indoor air quality (IAQ) is in the top 10 list of **“most urgent environmental risks to public health”**. The fact that nowadays we spend most of our time indoors (65% to 90%), at home, school or work, accentuates this risk. Some experts believe that most of the health issues we experience are from the effects of poor indoor air quality rather than outdoor pollution.

Poor IAQ is linked to asthma, general dizziness, eyes and nose irritation, cancer and other diseases. Some symptoms can be noticed immediately, meanwhile, other can take years to show up. Dr Michal Krzyzanowski programme manager for 'Living and Working Environments' at the WHO believes that **“Public health awareness of indoor air pollution has lagged behind that of outdoor air pollution”**.

The WHO has established that in the EU region at least 400 deaths are caused every year from carbon monoxide poisoning, and that up to 14% of lung cancers and 10 cases of leukaemia per 100 000 people are due to respective radon and benzene exposure at home.

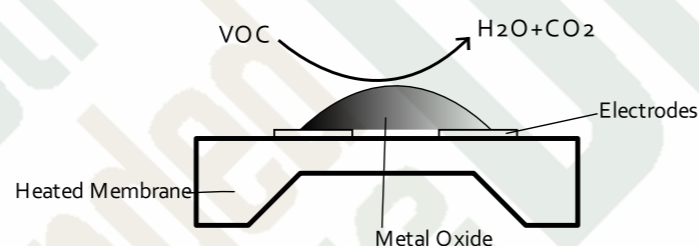
But not only at home, at work, the economic consequences are clear. Professor David Wyon of the Technical University of Denmark's International Centre for Indoor Environment and Energy, said, **“It has now been shown beyond reasonable doubt that poor indoor air quality in buildings can decrease productivity as high as six to nine percent”**.

The WHO already in 2002 ranked indoor air pollution as "eighth most important risk factor for disease, responsible for 2.7% of the global burden of disease and 1.6 million deaths due to chronic respiratory disease per year".

Increased awareness and promotion of behavioural changes can and will help mitigate poor IAQ consequences.

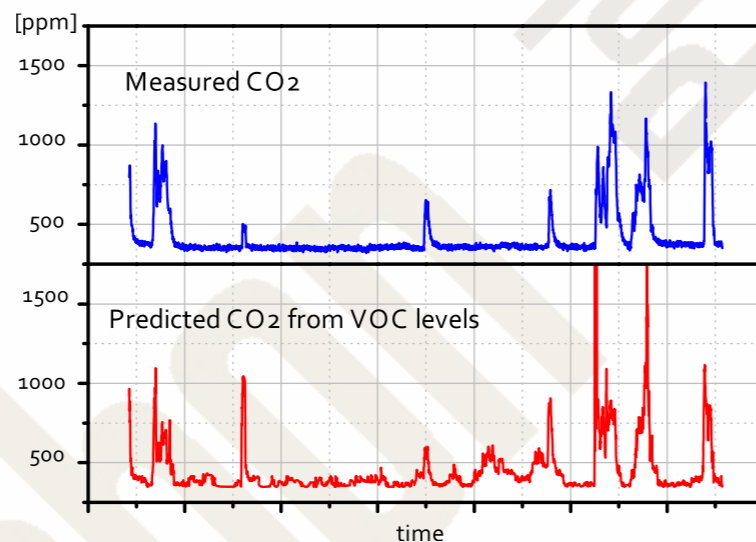
How gas sensors work

Volatile organic compounds (VOCs) sensors are produced by placing a semiconducting metal oxide on a substrate, heating it between 300° to 400°C and measuring the conductivity. Sensitivity towards combustible gases (VOCs, carbon monoxide, natural gas) is done by adding dopants of noble metals. This allows to create sensors for different gases.

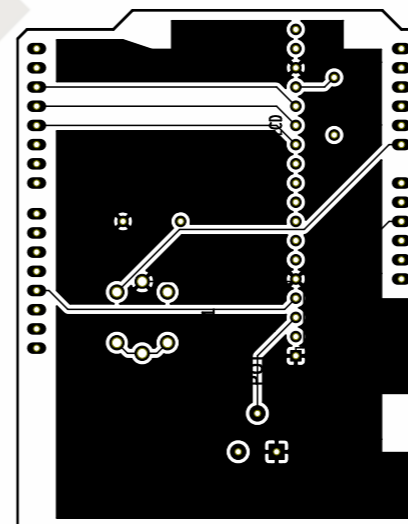
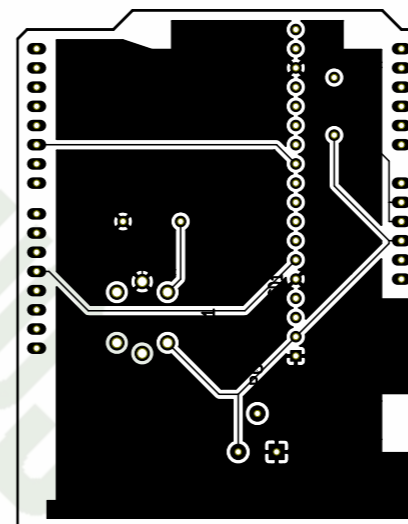
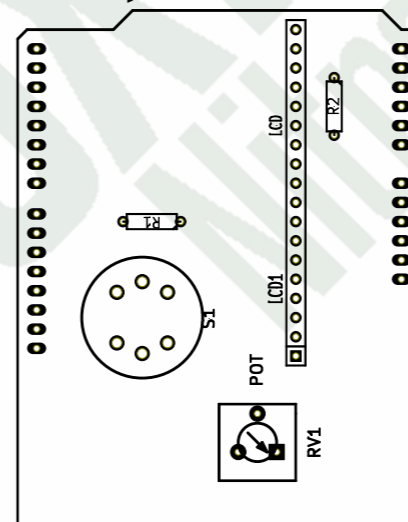


VOCs are combusted at the sensor surface, when reacting with oxygen molecules, electrons released by this chemical reaction, lead to a higher conductivity of the semiconducting material and this change can be measured by the microcontroller. Conductivity returns to its initial value once the gas is not present.

Measuring VOC levels shows an advantage from the traditional way of measuring IAQ from just Carbon Dioxide content in air. VOC sensors also detect other odorous events meanwhile faithfully predicting carbon dioxide levels at the same time.

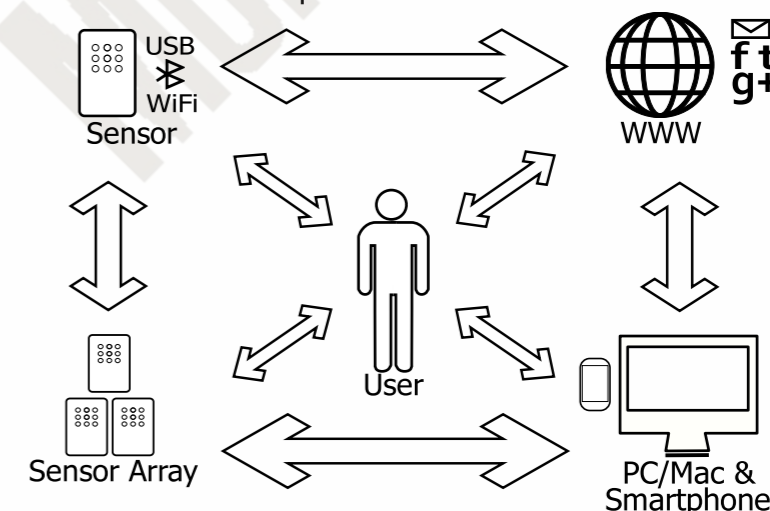


open hardware



Open hardware. Learn. Modify. Hack.

Our goal in class was to build a simple yet effective gas sensor to predict the presence of combustible gas in air. For that, we have created a simple electronic circuit that connects as a 'shield' to an Arduino board. The controller board and the parts needed to make this gas sensor are readily available from component distributors.



The final goal is to have a multifunctional sensor that measures indoor comfort by sensing indoor pollution levels (gas emissions, temperature, humidity, noise) and outputs them to your device of choice. You will be able to obtain pollution data at all times.

We are releasing the schematics and source code for the prototype as open source hardware. OSHW guarantees you the right of access to the hardware design. You can copy, redistribute, learn and modify this design, now and forever!

Sources:

- EN 13779
- THADE Report: European Federation of Airways Diseases Patients Associations (EFA) http://www.efanet.org/activities/publications_allergy.html
- EC Scientific Committee on Health and Environmental Risks (SCHER) http://ec.europa.eu/health/scientific_committees/environmental_risks/opinions/index_en.htm#id7
- WHO Guidelines for Indoor Air Quality <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality>
- Applied Sensor Inc. New Jersey, USA. <http://www.appliedsensor.com>