**CO2 gas sensor for air quality monitoring**

**Project Proposal**

The COVID19 pandemic is rapidly creating growth opportunities for CO2 sensors since there has been an accumulation of research works pointing towards the airborne transmission via aerosols as the major cause of infection [1] [2], and that transmission is more likely to happen in indoor environments. Subsequently, active ventilation in closed spaces like buildings is key to decrease the risk of infection [3] [4]. Moreover, it is also well known that either intermittent or long-term exposure to elevated CO2 concentrations in poorly ventilated spaces (5000 ppm and below) can lead to a variety of health problems and cognitive impairment [5].

Since CO2 is exhaled together with aerosols by the occupants inside buildings, CO2 concentration measurements have been identified as the best available low-cost tool to assess ventilation and risk of infection for high occupancy spaces. Hence, mass deployment of CO2 sensors would have been required at the beginning of the COVID-19 pandemic.

There are two major types of CO2 gas sensors that dominate the market, namely chemical sensors and non-dispersive infrared (NDIR) sensors, being the latter the more predominant. NDIR sensors use optical techniques that are based on the strong absorption of mid-infrared light by the CO2 around 4.26 µm.

NDIR-based methods are particularly suited for CO2 sensing and facilitate its implementation in very compact devices compared to other techniques. They use a source/detector setup that consists either of a lamp/thermopile detector or a LED/photodetector couple, placed inside a housing internally coated with reflective material along the optical path [6], which effectively increases the interactions between photons and the target gas molecules, improving the sensor sensitivity. Another advantage is that it does not chemically react with the target gas; therefore, no toxic by-products are released when measuring the gas concentration.

A roadblock for mass deployment is the cost, and the required infrastructure, namely the required power supply, communication means, and analysis computing platforms. Our goal is to implement a low-power system that can transmit the measured values to the cloud for later exploitation.

Our strategy will consist in providing edge computing resources close to the sensor, where the FPGA board provided for this year’s contest takes care of all the required data processing. The algorithm takes the signal from the different sensors (gas sensor, temperature) and computes the estimated CO2 concentration periodically. By bringing edge computing capabilities close to the sensor we expect to substantially reduce the energy footprint due to the communications of complex data to the cloud and its processing in remote servers.

The sensor can be used for smart home and building automation applications. By integrating CO2 measurement into these systems, significant amounts of energy can be saved and indoor air quality can be greatly improved, leading to a lower energy bill and a healthier indoor environment.

