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New IoT connected sensors to detect indoor air pollutants

Ex**tended abstract**. Current indoor air quality measurement systems very often fail to find causes for building related health issues. New measurements need to be developed to detect pollutants and their sources. Internet of Things techniques give new cost effective tools for this work.

Our experiments show that humidity can carry pollutants even when the pollutant itself is non-volatile.[1] By analysing the surface tension of water condensed from indoor air we can detect possible problem sources. A real time humidity condensing and water tension measurement system was developed using internet connected microcontrollers and cloud services [2]. Laboratory experiments were performed in glass chambers equipped with humidifiers, water vapour condensers, and sensors for temperature, humidity, total volatile organic compounds (TVOC), and water surface tension. It was shown that large size, non-volatile wetting agent molecules used in cleaning products (Genapol X080) can be detected in the chamber air using TVOC sensors. The surface tension of the condensed water also changed, when Genapol was added to the bottom of the measurement chamber. Condensed water samples were further tested for toxic effects in human cells and analysed using capillary electrophoresis to characterise the pollutants.

Hydrogen sulphide and other sulphides are harmful even in small concentrations. They can be introduced to indoor air from drains and plaster materials damaged by moisture, for example. Air borne sulphides tarnish silver. The tarnish on silver is measured with RGB-sensors to discover sulphide contaminations [3]. Using the developed IoT measurement system cumulative effect of sulphides in darkening the surface of silver was measured. The real time cumulative effect, the darkening of the silver surface, is visualised in real time using ThingSpeak cloud service.

Both Internet based methods enable detecting and eliminating indoor air problems even before they cause harm to people.

Keywords: Internet of Things, Indoor Air Quality, humidity, condensation, surface tension.

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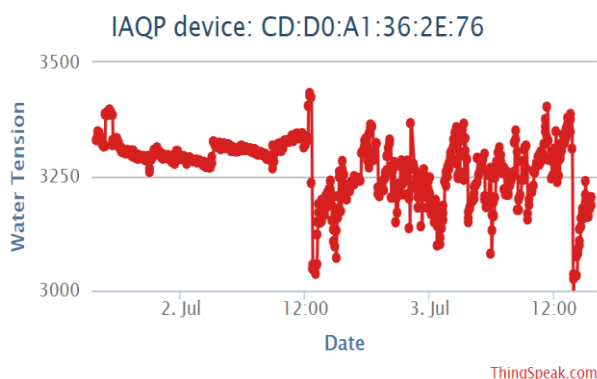
Figure 1. The graph from cloud service shows how the surface tension of chamber air water vapour condensate was affected by placing of a Genapol X080 containing tray onto the chamber floor at 12.39 o'clock.