**Indoor Environment Quality - Required Sensor and Data Set Research**

Discussions with Richard Francis suggest that the key findings of his research indicate that there are several key IEQ sensors that are desirable indoors, depending on circumstances, including:

* Light Levels & Quality (stated preference for natural light - but can this be sensed?)
* Noise Levels (noise = distraction)
* Pollutants (e.g. VOCs, CO2, CO)
* Temperature (i.e. thermal comfort)
* Air Pressure (a positive air pressure can reduce infiltration of external air, although there is some suggestion that there may be more direct impacts on building occupiers related to air pressure)
* Humidity (high humidity leads to mold formation, low humidity can lead to respiratory problems for occupants)

The WGBC report also identifies a number of aspects to judge the quality of an environment which are not likely to be able to be sensored e.g. views of nature, acoustics, interior layout, active design. As such, it may be that these be included as static/situational data sets to allow for fuller analysis.

An important aspect of his research indicates that the requirements for sensors are not universal and that depending on the indoor environment, e.g. what it’s used for or where it’s located, different sensor sets are required. As such, it may be an important aspect of our research to look at differing requirements in different room types, not just assume that one-size fits all.

Interestingly, RF is finding a higher level of interest and uptake in the Retail sector rather than Offices, as retailers can measure benefit directly through increased sales and the like, whereas in an Office environment it is a lot more difficult to determine positive/negative outcomes, suggesting that while measuring IEQ is good, understanding its impacts is better.

As per the WGBC Report on Health, Wellbeing and Productivty in Offices (http://www.worldgbc.org/activities/health-wellbeing-productivity-offices/) , there are three aspects of the measureability of IEQ, including:

1. Financial metrics
2. Perceptual metrics
3. Physical metrics

The first would require data to be accessed from the office occupiers, possibly engaging with HR and finance functions, and as any impact is likely to be longer term both these aspects suggest the data is not ideal for the IoT Launchpad project. The second is similarly outside the scope of the project, requiring engagement directly with office workers.

However, the third is a potential source of measureable data, with the introduction of portable and wearable technologies for building occupiers. Not sure if this is relevant for the IoT Launchpad project, given timeframes and scope, but may be worth noting in terms of potential for a future sensor mix in the spaces we’re investigating. (e.g. imagine if you had a TfL app/widget on your phone that communicated air quality information when the user passes a bus shelter.)

(Note that this isn’t necessarily far away, recent conversations in the market suggest that mobile phone manufacturers are not far off installing air quality sensors in phones as standard. In CHina cars in particular have this technology, allowing automatic control over air conditioning and windows when a car enters a high VOC zone. --How would this potential transient data availability impact on potential roll out of OpenTRV sensors? Would they compete, or enhance? Could a beacon that communicates with the app form part of the OpenTRV deployment?)

**Outdoor Environment Quality - Required Sensor and Data Set Research**

Regarding data & sensor requirements for outdoor monitoring when relating to office space, the feedback we seem to be receiving is that it’s the comparison between indoor and outdoor environment quality, particularly air quality, which is of particular interest. Landlords are looking to show that their buildings office a better quality of environment than the immediate surroundings, including:

* Pollutants
* Temperature
* Air Pressure
* Humidity

As such, the suggestion is to build a comparable set of sensors for air quality in particular to complement the indoor air quality sensors. i.e. no need for noise or light sensors, but the remainder of the sensor set could be useful as a comparator.

Question here is whether this outdoor quality could be provided by allowing landlords / occupiers to tap into the TfL dataset rather than deploying sensors on each individual building - could it be seen as an additional benefit of deploying the TfL sensors as a source of (relatively) local environmental quality data? Might not be relevant/available in all cases.