PPIEM: Privacy-Preserving Indoor Monitoring

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PROJECT TIMELINE

Start date: 15/05/2021.

Finish date: 31/01/2023.

INTRODUCTION

The poor air quality of our indoor environment can have significant short and long term health consequences. Organisations monitor indoor environments, using for instance sensors for CO2, temperature, and humidity. However, such measurement can cause privacy concerns. It is possible to infer occupancy within a space using environmental data. Although occupants might be willing to see their environment improve, they are less likely to use a space where their employers or friends can infer sensitive data about them, such as where they are and who they are interacting with. It is crucial to take into account and address these privacy concerns while monitoring indoor environment
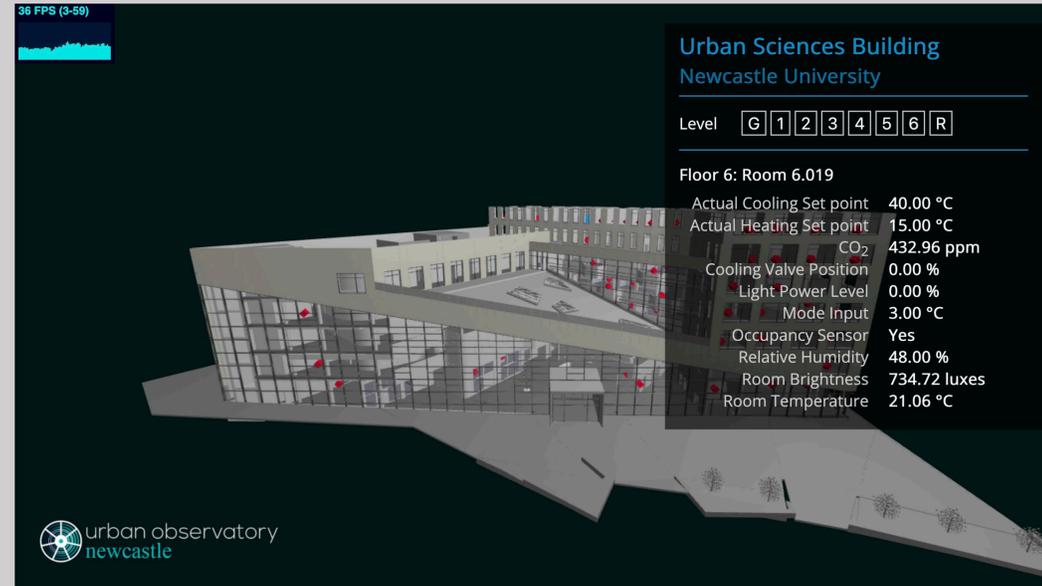
AIM

To provide the first generation of privacy-aware indoor environment sensors.

WHY

We are increasingly aware that poor indoor air quality can have significant short and long term health consequences. Organisations have therefore identified the need to monitor indoor environments, and some recent buildings come equipped with fine-grained sensors for CO2, temperature, humidity, etc, to provide intelligent control. Ventilation monitoring is also increasingly used to manage COVID-19 transmission risk. However, such pervasive measurement can, legitimately, cause some privacy concerns.

METHODOLOGY

This project will involve different steps: baseline of occupancy detection; anonymisation techniques on smart building data; and proof-of-concept privacy-aware indoor environment sensors

36 FPS (3-59)

Urban Sciences Building
Newcastle University

Level G 1 2 3 4 5 6 R

Floor 6: Room 6.019

Actual Cooling Set point	40.00 °C
Actual Heating Set point	15.00 °C
CO_2	432.96 ppm
Cooling Valve Position	0.00 %
Light Power Level	0.00 %
Mode Input	3.00 °C
Occupancy Sensor	Yes
Relative Humidity	48.00 %
Room Brightness	734.72 luxes
Room Temperature	21.06 °C

urban observatory
newcastle

KEY COMPONENTS:

– PPIEM is building sensors by establishing a baseline of occupancy detection in the Urban Sciences Building at Newcastle University, with environmental sensors in every office.
– Data anonymisation techniques are applied and builds a machine learning predictor for operational building controls.
– Privacy model allowing users to set their privacy preferences
– Handle user privacy preferences properly
– Implement and validate a proof-of-concept privacy-aware indoor environment sensors.

EXPECTED IMPACT

The work is timely and significantly important for smart spaces management and users wellbeing. It will
✓ Provide privacy-aware sensors
✓ Consider Users privacy preferences in the monitored spaces
✓ Provide a better experience for users in smart spaces with privacy concerns
✓ Find the trade-of between data privacy and usability
✓ Occupancy detection
✓ Resources consumption optimization
✓ Better experience, comfort, services optimization
✓ Access control
✓ Air quality optimisation (Sensing CO2, temperature, humidity, …)
✓ HVAC (Heating, Ventilation and Air Conditioning) management

✓ KEY FINDINGS

✓ Potential commercialization of the proposed sensors with privacy by design
✓ Value proposition for commercialising the research outcomes

USER PARTNERS

Cube-Creative Spaces Management, SIEMENS AG

ACKNOWLEDGMENT