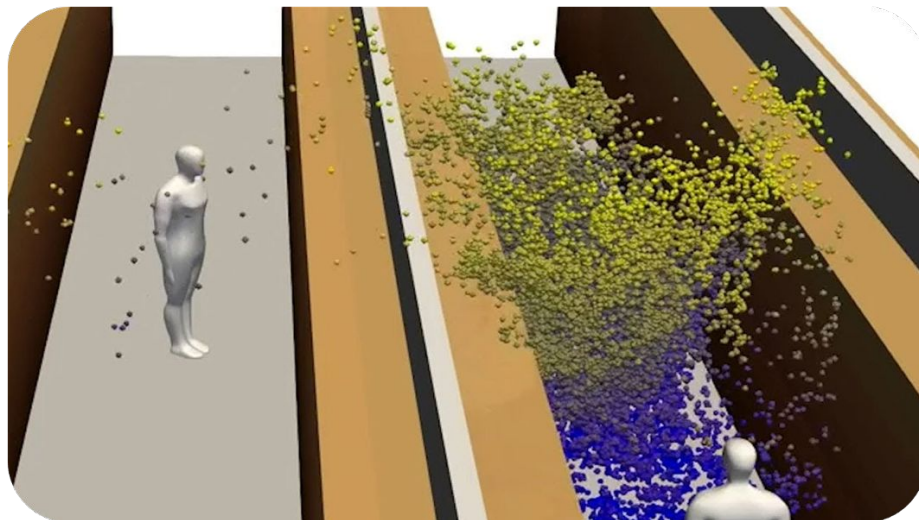


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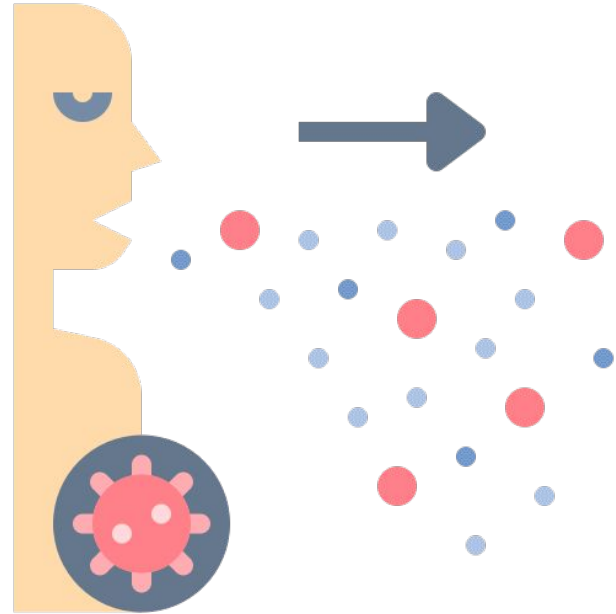
Airborne Contaminant Management Within an Indoor Environment

Azure Championship 2020 Presentation:
By Garry Clawson and Callum Thompson
1st July 2020 - 14:15

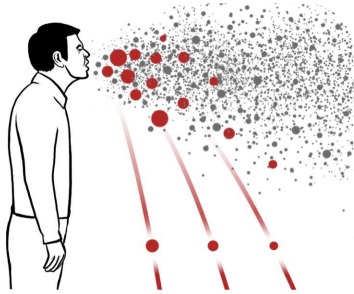


How COVID-19 Shaped Our Submission

- Airborne transmission is a major route to infection
- Indoor environments are particularly susceptible
- Difficult infection pathway to manage using manual processes
- Reducing this pathway could save lives



Why is Airflow Management Important?



Droplet (short range)
Aerosol (long range)



Humidity &
Temperature
conditions



Interaction of People
in enclosed spaces



Unknown surface
Contamination

Concept Overview: Wearable Technology

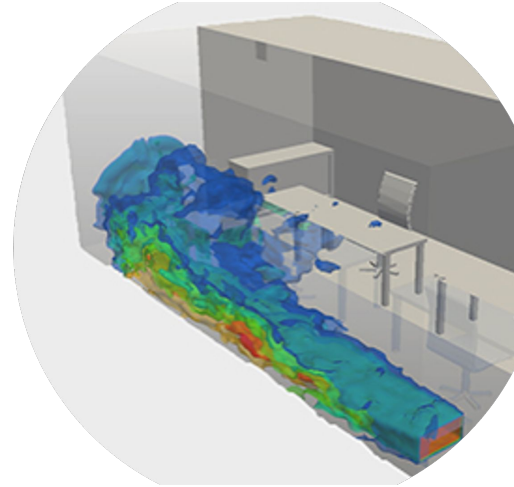
- Monitoring and managing people's health with wearable technology
- Ability to dynamically control your surroundings
- BMS do not respond to users, only the environment



Philips BioSensor

Concept Overview: Leveraging Azure

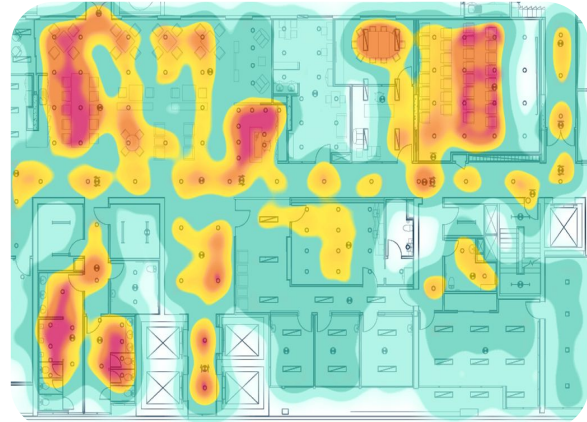
- Use of Azure services to facilitate IoT devices to support air flow management
- Streaming personal data via wearable technology - coughs and sneezes
- A dynamic building using ML and AI
- What are the current limitations?



Airflow Circulation Map

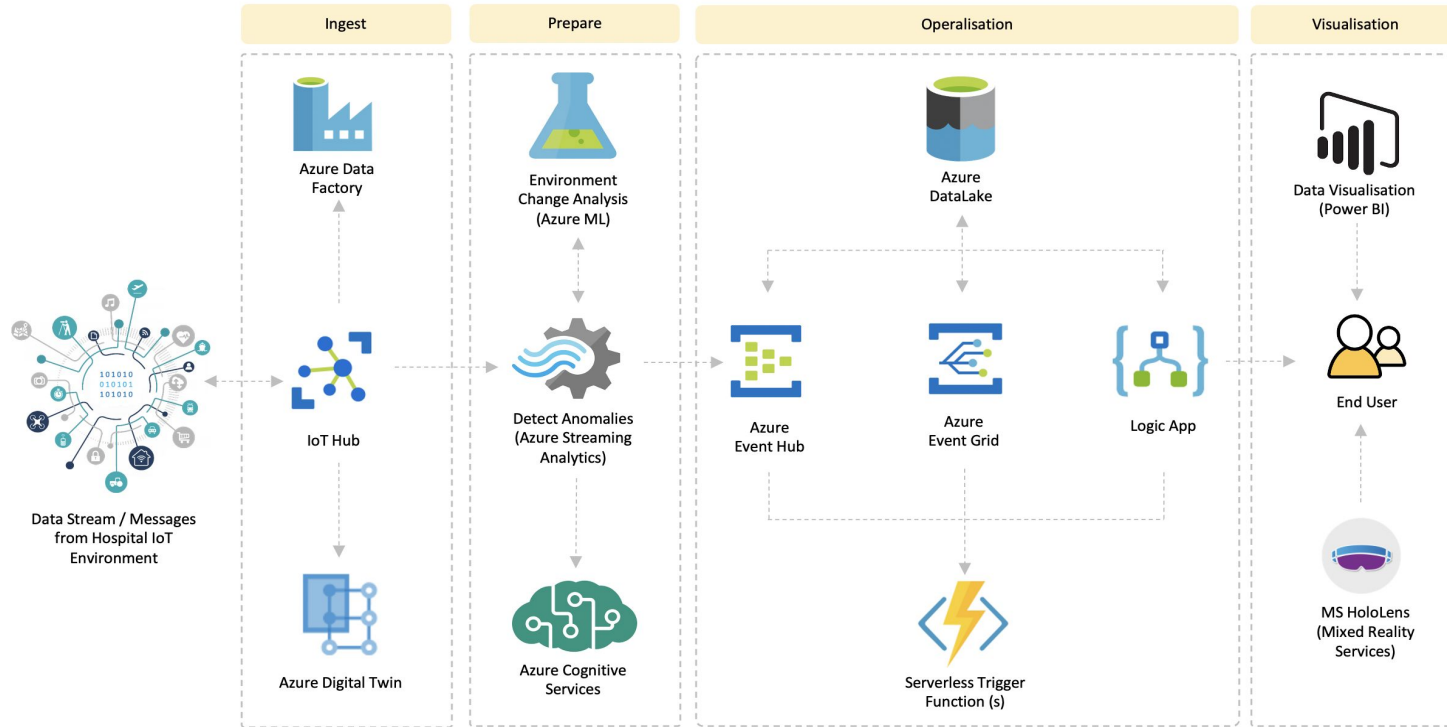
User Interaction: People First

- *'Always On - Always There'* philosophy
- Maps constructed using Digital Twins and ingested data
- Philips Internal GPS - who and where
- IoT devices - linked and synced
- Safest egress for contaminated air - pathfinding via Dykstra or A*



Realtime Contamination Map

Concept Architecture Design

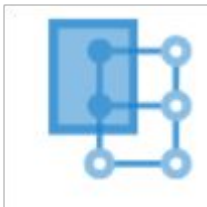


Implementation: Key Services



IoT Hub

*Ingesting large
amounts of IoT data
for analysis*



Digital
Twin

*Replicate real
environment
digitally*



Cognitive
Services

*Spot Normal Vs
Abnormal Conditions*



Machine
Learning

*Improve intelligence of
how air flow moves*



Logic App

*Automated response
to conditions*

Concept Demonstration: <https://azurechampionship.azurewebsites.net>

Implementation: Primary Use Case

- Remove contaminated air - *Azure ML/AI*
- Live autonomous building - *Digital Twins*
- See contamination using AR/MR - *HoloLens*
- Monitor user metrics - *Phillips BioSensors*
- Monitor room metrics - *Kinect DK & Power Bi*
- Resource deployment - *Logic App/Event Grid*



Visualize, Respond & Remove Contaminated Air

Implementation: Secondary Use Cases



Security

*Ensuring non
contaminated spaces
remain secure*



Maintenance

*Identifying equipment
condition such as aircon
or extraction*

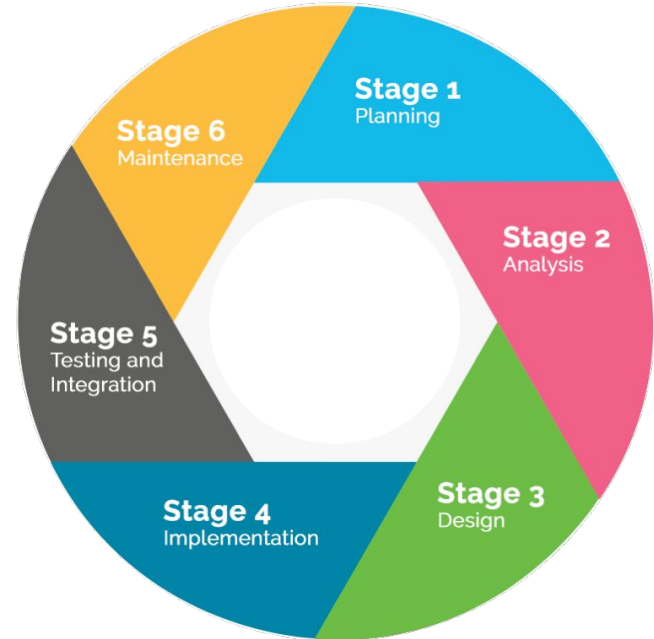


Cost Management

*Only responding
'where needed - when
needed'*

- Traditional BMS Cost (*circa \$750k for 120 beds*)
- Azure cost - minimal (*services + IoT technology*)
- Deploy in old and new hospitals
- Retrofitting allows phased implementation

Cost and Feasibility



Using Azure to build the first blocks of an '*Immune system*' for indoor environments to reduce airborne disease transmission.

