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Sensing visitor behaviour in museums

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1 Introduction

- Understanding visitor behaviour inside museums is complex, time consuming and expensive.
- A *digital twin*¹ can make different types of information (e.g., digital collections) accessible to visitors and managers.
- Strategically placed sensors can capture environmental information in real time.
- Sensed information can be used to understand visitors and their activities on the premises.
- Sensed information can be used to provide a gamified museum experience via smartphones.
- Information is aggregated in a dash-board in real time.

2 IoT Sensor Network

- Using sensors in museums was already envisioned in the first generations of sensor networks².
- We place small, thumb-sized, wireless, long-lasting, inconspicuous sensors in all rooms.
- Sensors continuously collect a variety of information (e.g., temperature, humidity, noise, CO₂, light)
- Sensor data can be combined to provide intelligible information such as the level of comfort within a room.
- Managers can infer number of visitors and duration of stay from CO₂ levels, and continuously compute indices such as attraction power and holding power³.

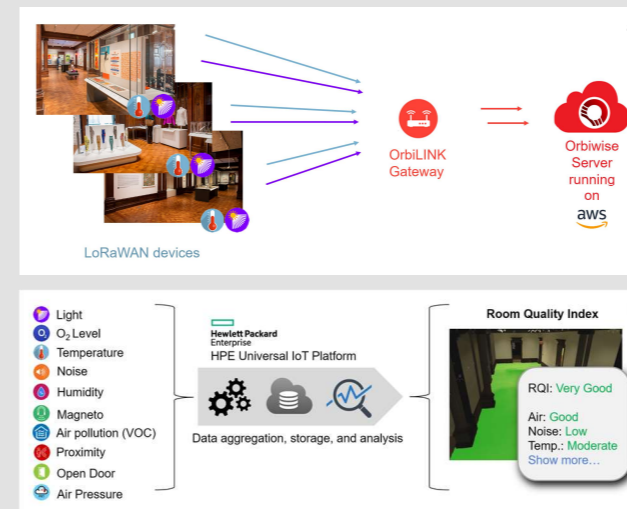


Fig. 1. a) Sensor data is gathered over gateways and stored in the cloud. b) Sensor data is aggregated and transformed into indices visualized in a 3D representation.

4 VR Dash Board

- A dash board⁶ serves as a go-to point for data visualisation and analysis.
- The digital twin consists of the sensor data, user data, and digitized museum collection.
- To explore data, we create virtual reality-based tools for exploration and mining of data⁷.
- The proposed tool chain can also contribute to evidence-based design and post-occupancy evaluation of buildings.
- Collected data can identify locations of high and low activity based on user behaviour and environmental circumstances.
- This data can be used to inform future design interventions (e.g. re-arranging paths through the museum that improve the accessibility and permeability of the layout).

3 Smartphone Gamification Platform

- Smartphones act as a gateway to provide users with a gamified experience⁴.
- Augmented Reality (AR) can be used to create rich media to engage patrons (e.g., by showing similar paintings next to original or by virtually completing broken artefacts)⁵.
- AR Produces an additional layer of data on user motivation and interaction.
- AR can be used engage visitors in insightful games (e.g., treasure hunts).
- Visitors can show and share their engagement with achievements (e.g. exploring all rooms, spending time at an exhibit, etc.)
- The interaction between the sensor data and user behaviour can be explored for both scientific and operational purposes.
- *Sensor and smartphone data can be used to compare user experience to environmental variables to investigate changes in attraction and holding power.*

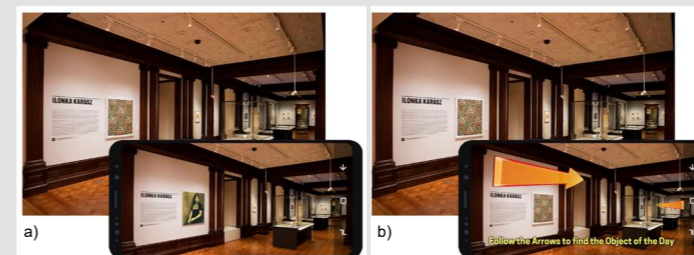


Fig. 2. a) Overlaying art work with alternative related displays. b) Overlaying waypoints to help navigation in the museum.

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