Sustainable Intelligence

Towards a Sustainable University Campus

GDPR Compliance Framework for People-Counting Sensors

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Infinite Possibilities

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1. Project Overview

1.1 Scope

Funded by the Higher Education Agency, the *Towards a Sustainable University Campus* (TSUC) is a €1 million decarbonisation initiative aims to transform the university's buildings into hubs of sustainability and innovation through smart energy management, health and comfort monitoring and reporting, and data-driven decision-making. The project will pilot a scalable digital system for energy reporting in three university buildings that TU Dublin will retain to 2030 and beyond per the Public Sector Climate Action Mandate and TU Dublin's Climate Action Roadmap.

The selected buildings are:

Greenway Hub: Located on the Grangegorman City campus, the Greenway Hub, built in 2017, hosts the "Sustainability and Health" research hub. This 4,270m2 building has many research laboratories that are energy-intensive spaces, making it ideal for showcasing the potential for carbon footprint reductions in such buildings.

Tallaght Main Building: Located on Tallaght campus, this large 15,620m2 building was built in 1992. It is a challenge because of its size, age, and multi-functional usage, including teaching, research, administration, and large communal areas. The building is connected to a district heating system supplied by the AWS data centre. This building is an example to identify scalability issues when replicating the project to other buildings and to showcase the return on investment for energy and water conservation measures.

Áras Eolas (Block E): Located on the Blanchardstown campus, this smaller 3,820m2 building built in 2002 mainly contains classrooms and laboratories. A key advantage of this building is that it is a perfect replica of Áras Fioas (Block F), which will undergo a façade retrofit upgrade, thereby providing valuable insights on the resulting energy and cost benefits by comparing baselined and adjusted energy consumption while also being a case-study to optimise energy consumption in small educational buildings.

Digital technologies, including IoT sensors and interactive, user-centric dashboards, digital twins, and building physics models, will be utilised to enhance existing energy monitoring and control systems by enabling real-time energy data collecting, curating, validating, consolidating, centralising, securing and sharing data in a controlled manner is essential to allow technological, knowledge, economic, and societal growth. Also, the adopted living-lab approach will empower occupants and encourage their active participation in reducing the buildings' carbon footprint. Lessons learned from the pilot will also be shared with higher education institutions and the public sector, in general, to assist them in implementing similar sustainability initiatives and advancing their decarbonisation efforts.

The project will facilitate the development of informed decarbonisation strategies that are replicable and scalable across TU Dublin's campuses. Addressing inherent challenges such as fragmented and manual

energy monitoring systems, limited IoT adoption, and disconnected data repositories aims to position TU Dublin as a leader in sustainable campus management. This decarbonisation initiative aligns with the national climate strategy and the sustainable development goals (SDG), potentially enhancing TU Dublin's position as a leader in sustainability in the higher education sector by establishing and disseminating models of best practices for higher education and the public sector. The project formally commenced in November 2021 and has a duration of 36 months. The project team members are Dr. Philippe Lemarchand, head of Sustainability Intelligence, Dr. Ahmed Hassan, Dr. Tarun Kumar, and Dr. Kumar Raushan.

1.2 Project Objectives

The following six strategic objectives have been designed to be implemented over a three-year period to enhance smart building management, sustainability, and user engagement.

1. Develop a detailed monitoring action plan based on the core needs of network Building Management Systems (BMS) and integrate internet-of-things (IoT) technologies for energy consumed and produced, environmental conditions, services, and occupancies.
2. Pilot smart monitoring and reporting infrastructure over three buildings with different occupancy profiles and usage.
3. Benchmark the energy performance, comfort, and occupancy profiles of the three identified buildings.
4. Develop energy, comfort, and occupancy models.
5. Transform our buildings into interactive living labs with user-centric dashboards. These dashboards will help users understand their energy impacts and potentially suggest behaviour/activity changes to optimise building operations.
6. Develop initiatives to upskill staff and educate students, and the community.

2.0 People-Counting Sensors (PCS) GDPR Compliance

2.1 Introduction

As part of the TSUC project, integrating people-counting sensors (PCS) is essential to monitor real-time occupancy levels efficiently in pursuit of advancing the management of TU Dublin buildings. Our approach aims to balance enhancing on-campus sustainability and respecting individual privacy rights. The installation of PCS is categorised as an operational case study, and the initiative Is it is governed by GDPR compliance and TU Dublin's data governance protocols. This document outlines our approach to comply with the General Data Protection Regulation (GDPR) and adhere to the European Data Protection Board (EDPB) Guidelines 3/2019.

2.2 Purpose of Data Processing

The introduction of PCS aims to gather accurate, real-time occupancy data in the Greenway Hub building and potentially other campus buildings in future to help optimise space usage, improve occupant comfort and reduce energy consumption in alignment with TU Dublin's sustainability strategy. Integrating two complementary technological solutions, PCS and security camera data stream analysis, the procured system provides reliable occupancy metrics and can integrate with technology services, such as Building Management System, Facility Management System, Room Booking Platform, the academic calendar and timetabling.

Only the basic People Counting feature of the system is activated for this deployment. Other functionalities supported by the devices—such as MAC address tracking, demographic analysis, person re-identification, and skeleton tracking—are disabled. No video footage, image data, or personal identifiers are collected, stored, or processed.

2.3 Ethical Compliance Measures

The installation of PCS was preceded by developing a comprehensive data management plan to ensure strict compliance with GDPR and EDPB Guidelines 3/2019. The following measures are to be implemented to safeguard personal privacy during the data collection and analysis.

Anonymisation: According to the supplier's GDPR policy[1], the PCS anonymise data immediately upon collection. The sensors perform on-device processing with embedded hardware-based image masking to ensure no identifiable image or personal information is retained or transmitted. While hardware-level pseudonymised data can be used for real-time analytics, only fully anonymised data (e.g., aggregate entry/exit counts) is transmitted to TU Dublin. The anonymised data is non-identifiable and cannot be traced back to individuals. This process adheres to GDPR Article 5[2] concerning the pseudonymisation of personal data.

[1] https://www.footfallcam.com/people-counting/knowledge-base/chapter-19-general-data-protection-regulation-gdpr/
[2] https://gdpr-info.eu/art-5-gdpr/

Data Minimisation: The sensors are designed to collect only the data necessary for the specific purpose of monitoring building occupancy. The collected data is limited to counts of individuals entering and exiting spaces without recording or storing any personal details in line with GDPR Article 25[3] (Data Protection by Design and by Default) and Article 32[4] (Security of Processing).

Secure Data Handling and Storage: Data collected by the sensors is encrypted to prevent unauthorised access and ensure the integrity and confidentiality of the data. Additionally, all data processing and storage servers, whether hosted by TU Dublin or through an approved cloud service provider, are located within the European Union to align with the GDPR territorial mandates.

Access to Data: Access to the collected data is tightly controlled; it is restricted to the TSUC project team members and, where necessary, read-only permissions for aggregated data may be granted to project collaborators. This is managed through secure, password-protected devices and servers. Automated backups are scheduled regularly to a cloud-based server, with periodic integrity tests to ensure that data can be fully recovered in case of loss or corruption.

Data Breach Reporting: In line with the TU Dublin Data Breach Reporting & Management Guidelines, our project team is prepared to respond swiftly to any data breaches. This involves immediate notification to system administrators (Primary Users: Tarun Kumar and Kumar Raushan, Principal Investigator: Philippe Lemarchand, Campus and Estates Staff: Alan Bruce and Mark Geraghty), completion of the Breach Notification Form, and detailed communications with Technology Services and the Information Governance Office in TU Dublin. We adhere to all necessary steps to contain and assess the breach and, if required, coordinate with the Data Protection Commission and inform affected individuals to comply fully with GDPR and TU Dublin's data protection policies.

Data Protection Impact Assessment (DPIA): Although the nature of the data collected by our sensors generally does not require a DPIA, one was voluntarily conducted to evaluate and mitigate any potential data protection risks. This assessment ensures transparency and accountability, addressing GDPR Article 35[5] requirements, and is revisited whenever there is a significant change in data processing practices or technology.

Engagement with TU Dublin Data Protection Officer: Our project team worked closely with TU Dublin's Data Protection Officer to ensure all data collection handling protocols conform to GDPR standards and TU Dublin data protection policies. Meanwhile, a DPIA was conducted to evaluate and mitigate any potential data protection risks as described in the section above.

Rights of Data Subjects: To further engage and inform the building occupants at the GWH building, information on the people counting sensor project shall be published as news displayed on the televisions in the Greenway Hub, as news articles on the TU Dublin website, and in journal and/or conference papers.

[3] https://gdpr-info.eu/art-25-gdpr/
[4] https://gdpr-info.eu/art-32-gdpr/
[5] https://gdpr-info.eu/art-35-gdpr/

Additionally, informational signs about the PCS will be strategically placed at the building's front door and across different floors within the building.

To gather feedback from the building occupants, multiple communication mechanisms have been implemented. An engagement event will take place in Room GW-402 on 11 June 2025 from 14:00 to 15:00 in hybrid mode, where building occupants and stakeholders from Campus Planning, Sustainability, and Estates will be present. The session will include a presentation outlining the project scope and objectives, followed by a Q&A session to capture input from attendees. Additionally, signage informing users of the people-counting sensors and associated privacy measures will be displayed on every floor and at the main building entrance. The signage will clarify that only anonymised data is collected, and that no images, personal identifiers, or employee tracking is performed. This proactive approach ensures that all occupants are well-informed about the technologies in use and the measures taken to protect their privacy following GDPR requirements.

We recognise and uphold the rights of individuals under the GDPR, including the rights to access, rectify, or erase their data. Also, we ensure that all inquiries or concerns regarding personal data are addressed promptly and transparently.

3. Summary

The document in hand provides a comprehensive overview of the GDPR compliance measures implemented in the integration of PCS as part of the TSUC project at TU Dublin. The primary objective of these sensors is to enhance real-time occupancy monitoring, which supports the university's sustainability strategy by optimising space usage, connected technology services, and improving energy efficiency. Anonymisation of Data at Collection, Data Minimisation, Secure Data Handling and Storage, Proactive Data Breach Management, Engagement with TU Dublin Data Protection Officer, Engagement, and Transparency were the key measures implemented to ensure adherence to the GDPR and the European Data Protection Board (EDPB) Guidelines. This initiative is a GDPR-compliant operational case study and does not involve identifiable human subjects or research-based data collection. The project prioritises transparency through signage, engagement events, and privacy-preserving technology configurations.