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The ADAPT centre at Maynooth University and smart cities unit of Dublin City Council (DCC) are collaborating on a 2-year targeted project (since December 2022) to enable the development of a Digital Twin ecosystem and facilitate its application for stakeholder and community engagement.

Research Motivation

Digital Twin is a new emerging technology in urban planning which offers possibilities of advancement from traditional 3D city models towards AI driven living city models to simulate urban infrastructure system(s), improve city management process(es) and exploring new user-interfaces between communities, public authorities, service providers and researchers [2], [3].

This project (DT4E) intends to investigate and inform its role, benefits and potential pitfalls for efficient decision making, and diminished participatory inequalities.

Primarily, digital twin refers to mirroring physical system(s), process(es) and asset(s) to their digital counterparts via linking multiple layers of information and data throughout their lifecycle [2], [3], [4].

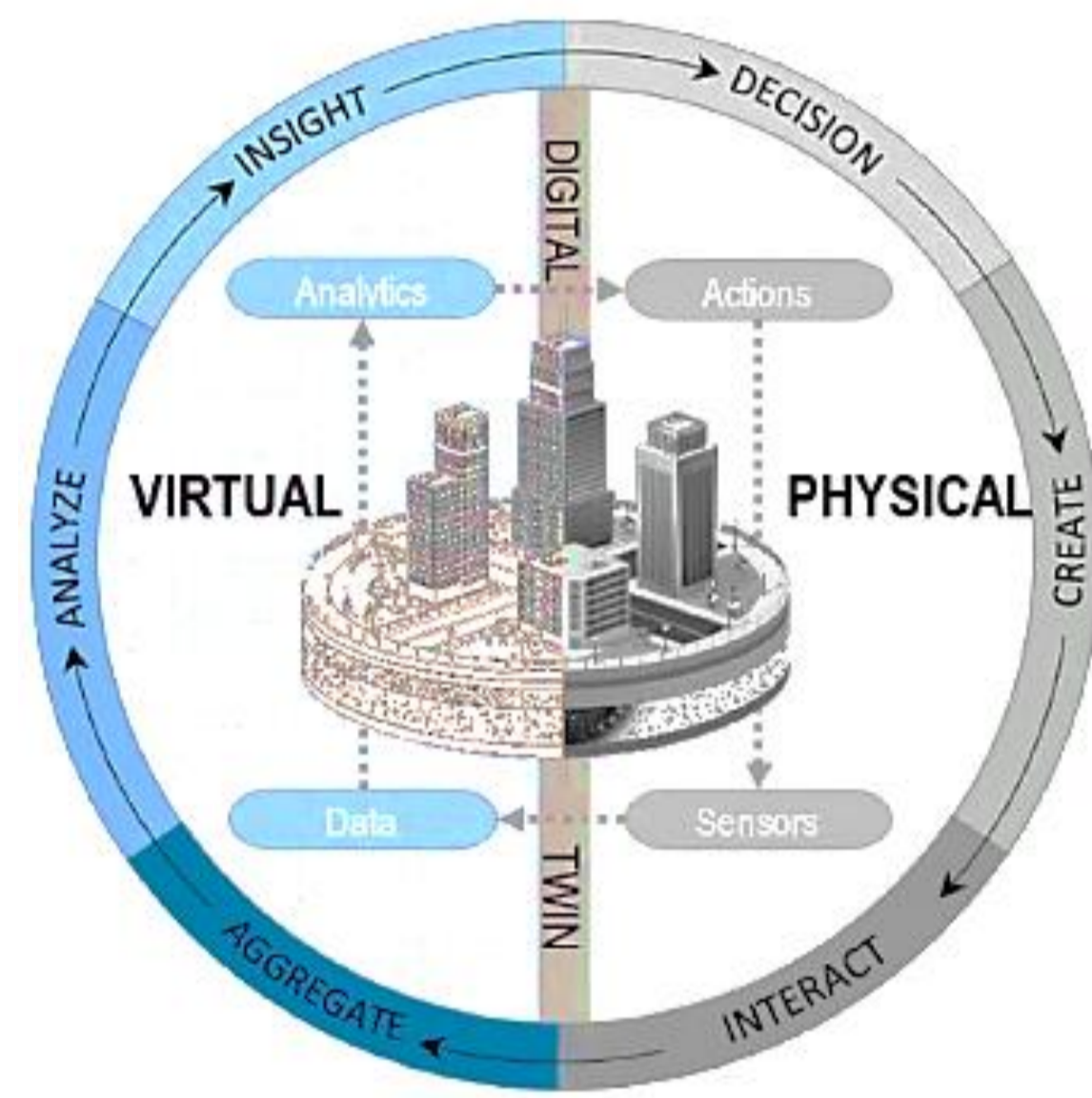


Image Credits: Reference [4]

Core Objective

To develop a toolkit for stakeholder and community engagement using digital twin technology and trial proof of concept engagements for further optimization.

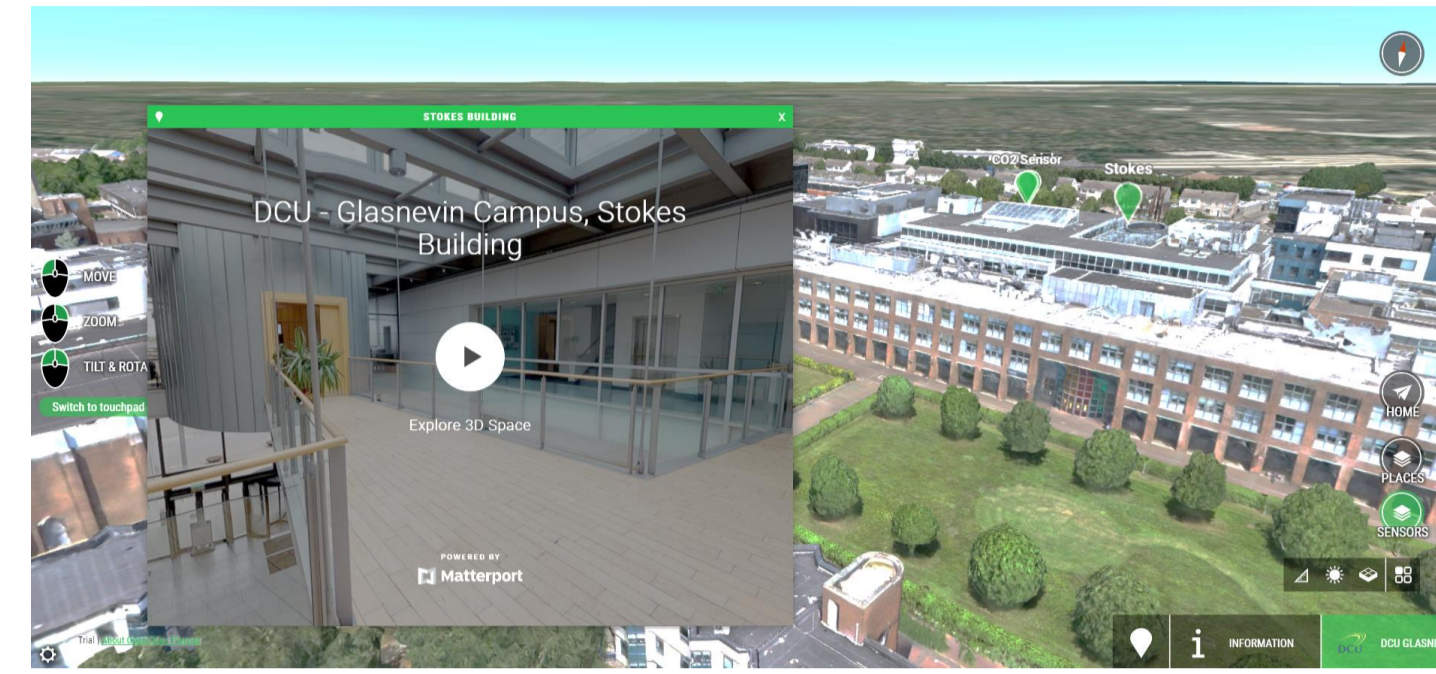
Research Questions

1. What are the challenges and opportunities in using digital twin technology for developing people centric, inclusive, sustainable and smart urban solutions?
2. How can we use digital twin technology to achieve international sustainable development goals aligning with DCC's priorities and goals?
3. What are the governance and ethical challenges raised during implementation of urban digital twins and how to mitigate them?

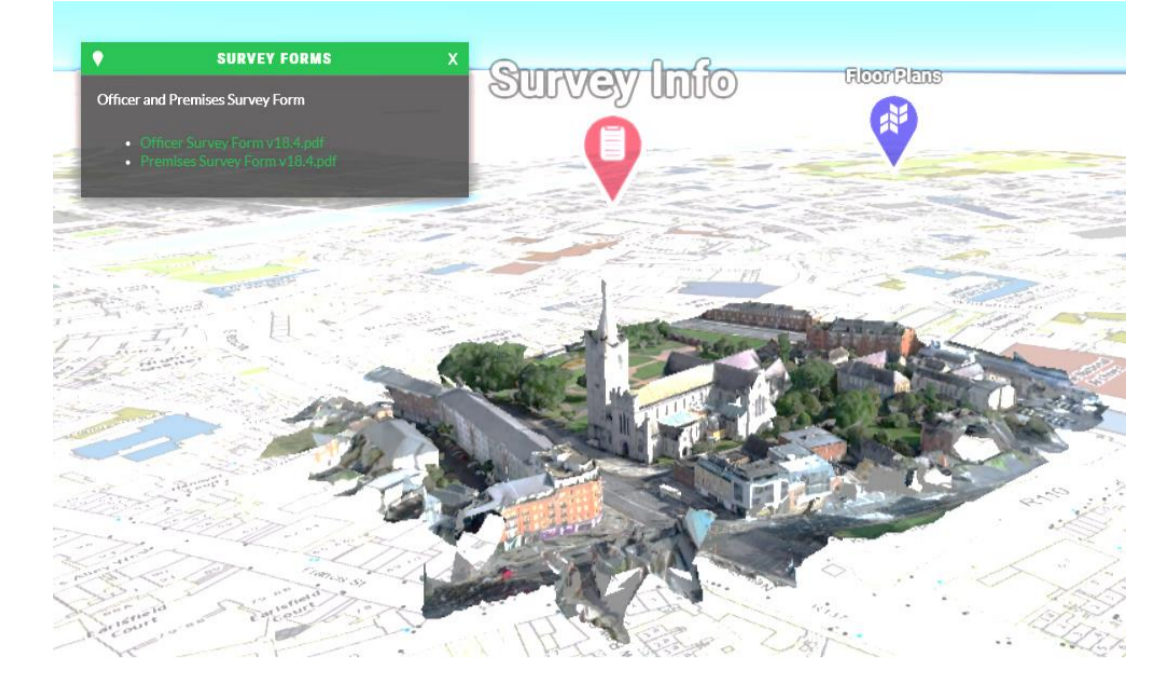
Project Goals

- To identify, evaluate and advance existing 3D modelling technology towards digital twin ecosystems for effective stakeholder and community engagement.
- To engage with and encourage collaboration of all stakeholders in the development and deployment of Digital Twin technologies across a wide range sectors and applications.
- To evaluate and mitigate ethical challenges in deploying digital twin technologies for stakeholder and community engagement.

Mapping the Digital Twin Ecosystem at DCC



Smart DCU – Glasnevin Campus



Dublin Fire Brigade Models



Docklands Model in Unity Engine



3D Hackathon in 2019



Potential Benefits of Urban Digital Twins (adapted from literature review [1], [4], [5], [7])

Implementation Challenges

Data Management	Visualization	Data Integration	Privacy Issues	Predictive Capabilities	Scaling Solutions
<ul style="list-style-type: none"> Data acquisition/processing. Storing large-sized geospatial city data. Accuracy of city information. Standard data schemes for replicability. Lack of governance structures. 	<ul style="list-style-type: none"> Graphical representational qualities. Accessibility for public engagement Untrusted crowdsourced data. Lack of contextual factors and non-physical. 	<ul style="list-style-type: none"> Ensuring interoperability among diverse datasets. Integration and collaboration qualities. Lack of data standardization for the generated heterogeneous data. 	<ul style="list-style-type: none"> Digital trust, privacy, accuracy, cybersecurity and governance issues. Understanding of potential impact on identified stakeholders. 	<ul style="list-style-type: none"> High costs of implementation. Targeting bidirectional information flow. Efficient communication networks such as 5G required so that IoT devices can relate to high-speed network. 	<ul style="list-style-type: none"> Requires high levels of integration. High information complexity. High chances of adopting a market-oriented strategy. Upskilling of government staff. Low participants readiness.

(adapted from literature review [1], [6])

References

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