

A Multi-Faceted Technological Approach to Citizen Participation: The Dundrum by Design Initiative

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Abstract: Technological approaches in urban planning processes can offer long-term benefits, including citizens empowered to co-design their towns, increasing the likelihood of public project approval, and a variety of solutions tailored to a town's needs, such as general climate adaptation. Ireland has been slow to adopt digital technologies in the non-statutory phases of urban planning, limiting itself to rigid, bureaucratic statutory processes. Dundrum by Design is presented as an innovative case study that aims to bridge the gap between local authority, communities, pedagogy and technology. Using semi-interoperable design platforms, Dundrum by Design broadens the public's accessibility towards participation in these crucial early stages. Community inputs have created a substantial database for the local authority and the Dundrum Living Street scheme, advancing conversations in each phase as the initiative progresses. Our findings show the initiative's gradual public acceptance and increasing community uptake, results likely derived from the transparency of digital tools used and the relationships built with community groups. The initiative's results aim to equip the local authority with data-backed solutions, sensitive to the local community's needs and to climate adaptation, while also providing technology-based capacity building for future schemes.

Keywords: Geodesign, climate simulation, community engagement, digital tools

1 Introduction

For decades, urban planning has been slow to address the technological gap between meaningful citizen participation and urban design processes (HUDSON-SMITH & SHAKERI 2022, SONDOU et al. 2025). As society becomes increasingly urbanised and digitally advanced, an additional need is placed on methods that promote a just, people-centred, climate transition (TURILAZZI et al. 2021, KAVOURAS et al. 2025). Meanwhile, histories of top-down approaches and a lack of transparency result in low trust and little community participation (ARNSTEIN 1969, GABER 2019). Research indicates that supporting community co-participation, co-design, and co-creation in early urban design discourses can facilitate the growth of green, sustainable neighbourhoods (BUIJIS et al. 2024, KAVOURAS et al. 2025). Moreover, the use of technology further promotes transparency and a holistic picture of the future (LIN 2022, OH & RYDIN 2025).

In this context, the 2025 Dundrum by Design initiative (DbD) is introduced as a case study that utilises innovative methods and digital platforms to bring local voices into design deci-

sions that aspire to shape the future of Dundrum.¹ As an ongoing collaboration between University College Dublin (UCD) School of Architecture, Planning and Environmental Policy, Dún Laoghaire-Rathdown County Council (DLR), and the Dundrum community, it is framed within the EU-funded PROBONO project. DbD adopts the Living Lab approach (VOYTENKO et al. 2016) to combine state-of-the-art technical and social innovations for the climate transition. It also takes a pedagogical approach, involving UCD Architecture students in climate-sensitive, real-world problem-solving with the community, co-developing collective visions for the village while situating proposed interventions within the realities of the current climate context.

Through the PROBONO Dublin Living Lab, DbD provides an opportunity to prototype and evaluate innovative methods and tools, such as the geodesign approach, for engaging a wide range of stakeholders, including local communities, in the green transition process. DbD's focus is on Dundrum's historic streets, particularly Main Street and Taney Cross, which are undergoing significant transformation. These include the redesign of the junction to enhance the pedestrian experience, improving the public realm, and reconnecting with the remainder of the major town centre; the proposed redevelopment of the Old Shopping Centre, featuring a new public park. The Council's vision is to make Dundrum a more pedestrian-friendly village centre with active, inviting public spaces and parks while enhancing its historic character and supporting a vibrant local economy. By employing innovative technologies, DbD encourages stakeholders to flag other areas requiring interventions, supporting a broader range of citizen input. The input collected from the partnership process will be shared with DLR and taken into consideration, particularly for the Dundrum Living Streets project, a scheme focused on promoting sustainable mobility and enhancing the public realm.

DbD's use of multiple semi-interoperable digital platforms intends to diversify early consultation as part of non-statutory processes and provide participation opportunities as the project progresses. These platforms record citizen desires, conduct debriefings, elaborate various climate simulations and integrate community-informed student interventions. Meanwhile, climate simulations equip DLR with contextual climate solutions, based on existing data and future projections. The project also builds on previous geodesign workshops led by UCD (COCCO et al. 2025), incorporating lessons learned and methodologies, whilst in parallel aligning DbD with broader frameworks such as that of the New European Bauhaus.² Therefore, when faced with the current challenges of implementing a valuable community-centred technological approach, DbD intends to answer the following questions:

- 1) How can urban design processes engage diverse stakeholders – local authorities, academic institutions, private enterprises, citizens, and community groups – in a co-design process that incorporates local knowledge and expertise?
- 2) How can a technological approach substantially benefit all parties involved and provide a starting point for future urban discourses?

¹ Dundrum is a neighbourhood located in Dublin's outer suburb, and it is considered one of the two "Major Town Centres" of the Dún Laoghaire-Rathdown county, part of Dublin County. This study refers to the Dundrum Village as the area defined in the 2023 Dundrum Local Area Plan, encompassing a population of roughly 6,000 as reported in the 2022 census.

² https://new-european-bauhaus.europa.eu/index_en

The plan for DbD's activities was methodically set from these questions, as the project aspires to enact the shift towards people-centred planning processes. Where local authorities are bound by slow bureaucratic processes, rigid statutory structures and risk aversion, the case for testing the boundaries of possibility will be further explored in this paper. This paper argues that employing a multi-faceted technological approach in urban design processes helps local authorities boost community engagement and promotes a holistic, systems-thinking overview of Dundrum.

The assessment of digital participatory planning commonly distinguishes between workflow effectiveness, referring to the operational quality of the participatory process, and participation impact, which concerns the extent to which participation influences policy and decision-making outcomes. In relation to the workflow effectiveness, LEE et al. (2022) developed a comprehensive evaluation framework structured around four key dimensions: Feasibility (process viability given resources and capacity), Value (participant perception of worthiness), Change/Action (tangible influence on decisions), and Sustainability (long-term viability). ATAMAN et al. (2025) emphasise that critical success factors for digital participation in dense urban contexts include context-specific interventions, active engagement between residents and designers, integration of multi-scale datasets, and structured evaluation metrics. ATZMANSTORFER et al. (2025) further identified transparent dissemination strategies and active stakeholder engagement mechanisms as essential.

Against this theoretical backdrop, the remainder of the paper examines the methodology adopted to integrate a diverse set of digital tools within the DbD initiative. It then presents the results and data gathered throughout the project, which are subsequently evaluated in the discussion section against the frameworks for assessment outlined above.

2 Methodology

DbD brings together diverse stakeholders in a collaborative process, empowering citizens to take an active role in urban design. The Dundrum by Design workflow (Figure 1) follows a structured, multi-phase process that blends community insight, educational involvement, and digital tools to inform urban design. It begins with groundwork to understand stakeholders and local climate conditions (Preparatory Phase), followed by a Knowledge-Gathering Phase where residents, young people, and students share perspectives through mapping sessions, games, and discussions. The workflow then moves into hands-on workshops that use geodesign methods and tools, school-based gaming activities, and community voting to shape shared proposals (Workshop Phase). In the final stage (Post-Processing Phase), these ideas are refined through climate-focused simulations and compiled into a report that reflects the collective vision, including strong input from young participants.

Three principal digital platforms were used throughout the process to record responses and enable meaningful engagement from the various key stakeholders and the broad Dundrum community, to co-create ideas for a more vibrant, inclusive, and climate-resilient Dundrum village. These platforms, expanded on below, were supported by three official communication channels (website, social media and mailing list) and traditional engagement methods (flyers, posters, displays, public talks, meetings with community groups, etc). When combined, these platforms allow data to flow from the initial Knowledge-Gathering Phase to the final presentation, continuously building on the inputs acquired.

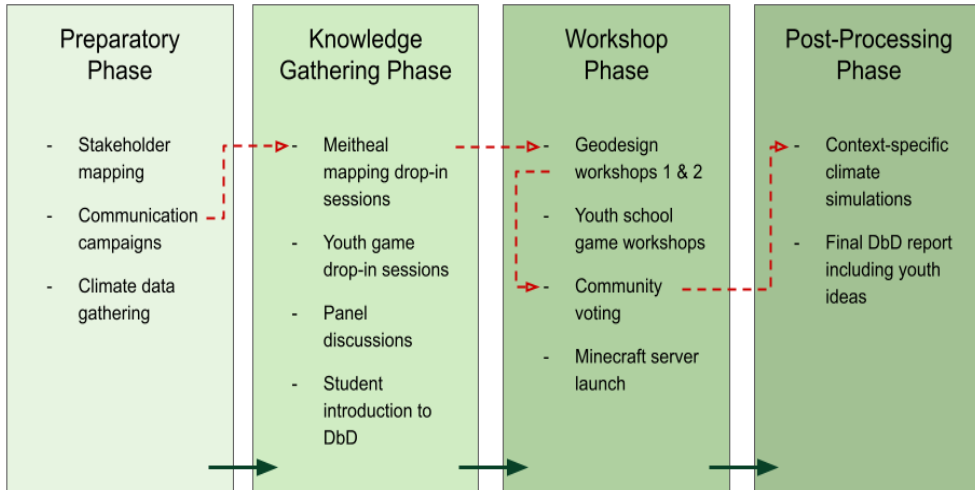


Fig. 1: DbD workflow diagram, including the output pathway between digital platforms highlighted in red

1. *Meitheal* Mapping (powered by CartoSpot) – The first platform used recorded community inputs during the initial project phase. Responses were geolocated on a map of Dundrum using a customised instance of the Cartospot.com geosurvey. The map-based participation platform (KULAWIAK et al. 2023) allowed community members to view inputs made by their neighbours, prior to making their own input. The Dundrum Stories and Values map³ gathered valuable contextual information, while the Dundrum Challenges⁴ and Dundrum Opportunities⁵ maps gathered input into 8 territorial systems (Amenity and Public Space, Retail Spaces, Green and Blue Infrastructure, Housing, Active Mobility, Connectivity, Vehicular Mobility and Heritage). Architecture students drew on these inputs as a primary reference to guide their design strategies and interventions, ensuring they reflect the community’s perspective. Outputs gathered were recorded on an Excel spreadsheet and were transformed into spatial representations, mapped as polygons on the Geodesign Hub platform in preparation for the geodesign workshop 1.

2. GeodesignHub – The community's input on Meitheal was used as the starting point during the workshop phase. DbD held a first community geodesign workshop⁶, using the GeodesignHub.com collaborative tool. The platform allowed community members and students to negotiate preferences and priorities for Dundrum. With the support of facilitators (Master’s students), participants divided into 6 stakeholder groups compiled each relevant Meitheal input into an overall map. Groups presented their maps before being joined into two coalitions. During the post-processing phase, two maps were created. The first map highlights shared priorities that both groups agreed upon during the geodesign workshop. The second

³ <https://meitheal.cartospot.com/map/dundrum-stories-and-values/>

⁴ <https://meitheal.cartospot.com/map/dundrum-challenges/>

⁵ <https://meitheal.cartospot.com/map/dundrum-opportunities/>

⁶ <https://storymaps.arcgis.com/stories/54c6fddc4cdf4649875dd9802c8ca899#ref-n-6mS5ik>

map, which contains 18 ideas where no consensus was reached, was hosted on DLR's community consultation platform, "Citizen Space," and used for community voting, allowing members of the broader community to express their preferences. The agreements and voting ideas that received between 60% and 100% approval were exported and will be tested across four areas in Dundrum as part of the urban climate simulation (geodesign workshop 2).

3. Minecraft – A combination of digital and analogue serious games was employed to collect input from Dundrum's youth. Minecraft was used as the primary tool to gain children's interest in Dundrum, enabling them to co-create spaces and interventions through their perspective (POPLIN et al. 2022). The tool, an intuitive and attractive method to engage young minds, at times coaxed adults to join. Its use during the early drop-in sessions also supported Meitheal, whereby parents waiting for their children to complete the urban designing activities would complete a minimum of one submission on Meitheal. A live Minecraft server is currently operating to collect youth input from ages 8 to 18, building on 5 school workshops that engaged 160+ students.

4. Urban Climate Change Research Network (UCCRN) Toolkit – To support the climate transition, a separate analysis is ongoing, informed by results from the platforms above. This analysis, led by researchers at the University of Naples, uses GIS and 3D modelling tools to assess climate risks, map urban heat island and flood zones, and quantify co-benefit (RAVEN et al. 2025a,b). Expected outputs include analyses of urban heat islands, projected climate, flood risks and strategies for climate and green interventions. Results from the first geodesign workshop and Meitheal offer a community-driven scenario testing framework, facilitating a contextual assessment of local climate conditions. Simulations, responding to various visions and desires, will be presented and tested at the second community workshop in January 2026. The outcomes will provide a comprehensive toolkit for DLR, relating to policy impact modelling and providing means for informed decision-making.

3 Results and Findings

The results gathered thus far indicate that a multi-platform approach can efficiently organise community inputs, boost local engagement and use general responses to answer specific questions. The preliminary results have confirmed the rise in local uptake of the initiative, providing descriptive metrics in addition to qualitative outcomes from the geodesign workshop and the subsequent analytics from the community voting platform.

Empowering local citizens to become active members in designing their future led to the general adoption of DbD as an initiative advocating for tangible change. As a clear product of this approach, the DbD mailing list rose from 30 registrations in one month to 149 at the time of writing. Similarly, traffic to DbD's official Instagram page increased from 2,000+ views during the first month of its launch⁷, to 88,000+ views by the end of October. Pedagogical implications accounted for 16,000+ views for a single post related to a large-scale student-curated event⁸ in the community. Furthermore, the first platform used to record citizen inputs, Meitheal, gained approximately 121 ideas across the 8 territorial systems. This

⁷ Dates: 30 July – 31 Aug

⁸ The event was carried out as part of Open House Dublin, a onfree festival of architecture held across the county. UCD's event in Dundrum can be viewed here:

later rose to 169 individual ideas after the geodesign workshop held in late September (16 community members participated), incorporating student interventions and counting the total community inputs. Although the overall number of ideas was reduced to 92 ideas relating to the Living Streets initiative, the gradual increase and general shift are evident (Figure 2). The community voting page gained a collective 455 votes across 18 Living Streets ideas in one month. Meanwhile, data on Minecraft, where youth engagement is carried out, is currently being collected and analysed.

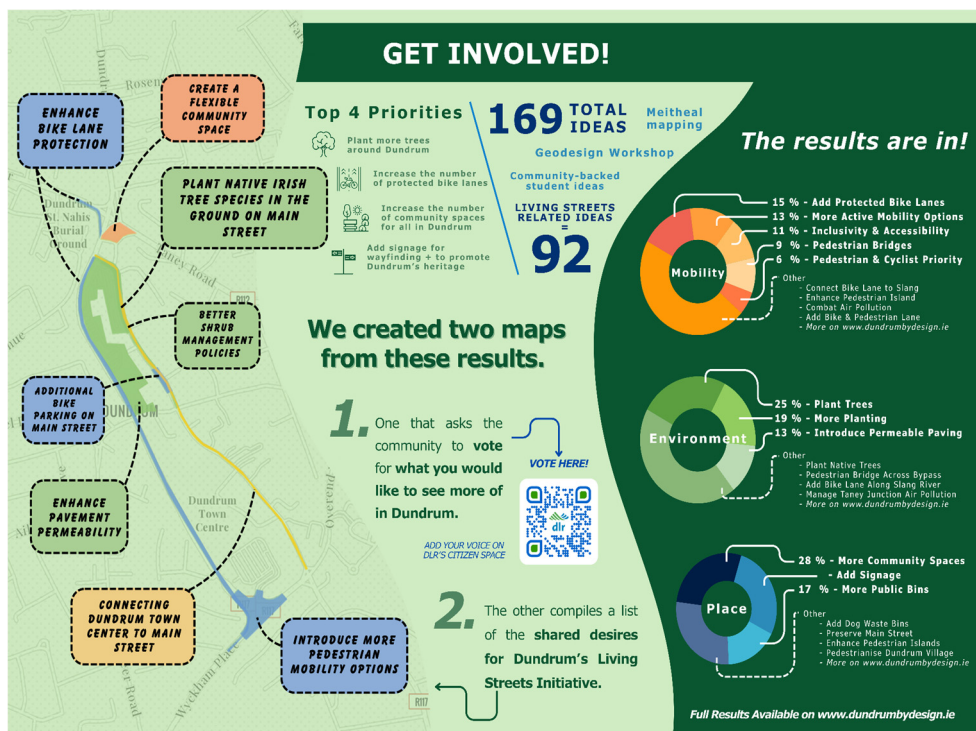


Fig. 2: Results poster used to communicate project progress to the Dundrum community

Analytics gathered as part of the initiative include a general sense of respondent demographics. Of the 149 mailing list registrations, 55% of registrants have identified as local residents, “I live in Dundrum”, with a further 7% indicating that they work or live and work in Dundrum. These results align with the profile of respondents who have participated in the community voting, where 63% are a “local resident living in Dundrum” and 2% are a “local business owner/employee”. Demographics also include a relatively even distribution between the proportion of men (43%) and women (40%) responding to the voting. Interestingly, a higher number of women (141) compared to men (136) responded as local residents on the community voting platform. Concurrently, the voting tool attracted increased participation

from the 35–44 age group, which – alongside older age groups – had already shown active engagement in the initiative. These results underscore DbD’s focus on engaging local voices, including those who work in Dundrum, in contributing to the initiative.

Qualitative results have been collected via the platforms employed. Original input collected on Meitheal created a set of common themes also evident across Minecraft, the community Geodesign workshop discussions, and the community voting responses. These pertained to urban greening (79% favoured votes), improvements to the active travel network (votes mixed across multiple ideas) and inclusive design (72% favoured votes). At the same time, data collection about the impact of DbD on participants advances as the initiative enters its final stages. Public response from the first geodesign workshop feedback survey presents a good perception, but is limited due to the low rate of responses. However, open-ended responses offer relevant insight towards participants’ appreciation of the process and highlight areas for future improvement:

“Well done, good initiative.” (Resident A)

“The technology gave small, fast moving results which were hard to see and follow. Great engagement from students. A real privilege to meet them.” (Resident B)

“It was very interesting to participate in such a well-organised event.” (Resident C)

In parallel, urban climate simulations, implemented in both GIS and 3D modelling environments (with a spatial resolution of 250m and 5m, respectively), include as primary outcomes the integrated assessment of i) heat stress and flood risk, ii) energy consumption and production from renewables, and iii) carbon balance accompanied by material flows and local storage capacity. These will be used in the second community workshop as essential components of the co-design process, to allow understanding and discussing the effects of changes in urban morphology and LULC (Land Use/Land Cover) on key environmental and comfort parameters. In addition, the synergies and trade-offs between climate action and socio-ecological co-benefits for local communities will be explored. The baseline scenario reflects the current climate and LULC, while alternative design scenarios under future (2030-2050) climate change incorporate the climate-resilient urban design solutions informed by the 92 ideas co-designed within Living Streets.

4 Discussion and Conclusion

DbD represents an innovative direction in representing citizen contributions to urban design processes in early urban design discourses. Improving accessibility and accounting for external circumstances, such as engagement fatigue or tech savviness, leads to greater trust, stronger connections and a climate-sensitive design. Applying a multi-faceted technological approach enables all stakeholders to collaborate within the context while responding to the Living Streets initiative. By simplifying the engagement process and leveraging the benefits of different platforms, the initiative provides multiple phases at which the community can provide input. Employing a pedagogical approach within the DbD partnership contributed to innovation and expanded visualisation possibilities, creating a space for knowledge exchange between students and the community. Key benefits to all three partners, UCD, DLR and the Dundrum community, include informed policy development grounded in realistic and tested simulations.

4.1 Assessing Digital Workflow Effectiveness in Geodesign

DbD demonstrates measurable workflow effectiveness across the four key dimensions developed by LEE et al. (2022). “Feasibility” is evidenced through successful multi-platform orchestration (Meitheal, GeodesignHub, Minecraft, Climate Modelling), engaging 160+ young people, generating 169 community ideas, and achieving 88,000+ social media views. ‘Value’ is reflected in organic engagement: mailing list growth to 149 registrations and 455 votes on contested ideas. DLR officials confirmed the initiative's value, stating it was “*useful to hear from the community as to what they would like to see in Dundrum*” and noting that “*the climate scenarios will be an input to future design that we would not otherwise have available to us*”. ‘Change/Action’ demonstrates tangible outputs through the transformation of scattered inputs into 92 structured Living Streets ideas and a number of alternative design scenarios, translating community visions into technical recommendations, though DLR noted it is “*too early to say*” which specific ideas will be incorporated into the final design. ‘Sustainability’ presents mixed prospects: positive indicators include the institutional partnership structure (UCD-DLR-community) within PROBONO, pedagogical integration with UCD Architecture curriculum, and the live Minecraft server maintaining youth engagement. However, community engagement relies on project-funded activities with no post-PROBONO participation mechanisms, risking participation fatigue without formal feedback loops reporting how inputs influenced final decisions.

DbD embodies the critical success factors identified by ATAMAN et al. (2025) and ATZMANS-TORFER et al. (2025): transparent multi-channel dissemination; multi-scale data integration connecting local knowledge (geolocated Meitheal inputs across eight territorial systems) with expert analysis (climate modelling); active engagement between residents and designers facilitated through UCD student interventions; and context-specific focus on Dundrum's 2023 Local Area Plan priorities. DbD employs a hybrid approach, strategically combining digital platforms with high-visibility traditional engagement, including community meetings, workshops, and a student-curated tactical urbanism event. This multi-channel strategy mitigates tech-literacy barriers by ensuring residents encounter the project through both physical presence and digital platforms, aligning with TEKLER et al.'s (2024) emphasis on qualitative assessment.

While DbD demonstrates strong workflow effectiveness, assessing participation impact reveals that the process is still underway. VRYDAGH (2022) introduced the Sequential Impact Matrix (SIM) methodology tracking with six stages: (1) decision-makers' pre-participation preferences, (2) citizen inputs, (3) post-participation decisions, and (4) congruence analysis between ideas and outcomes. DLRCoCo provided documentation of pre-participation priorities (Stage 1) through the Dundrum Local Area Plan 2023, revealing existing priorities for traffic management, pedestrian safety, and public realm enhancement. DbD successfully documents stages 2 and 3, capturing 92 Living Streets ideas and establishing community voting, with documented community priorities showing strong alignment with DLR's medium-term vision for pedestrian priority, heritage preservation, and placemaking interventions. However, as DLR noted, it is too early to say at this stage in the design process which specific community inputs will be incorporated (Stage 4).

While congruence between DbD inputs and DLR's pre-existing priorities is evident, the timing of the assessment means concrete adoption decisions are not yet available to fully validate participation impact. DLR confirmed that “*there will be further community engagement in*

the preparation of the scheme”, though specific mechanisms and timelines are still being determined. A complete participation impact assessment will require tracking which ideas are adopted and establishing formal mechanisms demonstrating how citizen inputs influenced final outcomes.

4.2 Limitations to Community Engagement

Early meetings with DLR uncovered the authority’s positivity in adapting this approach, stemming from first-hand accounts of the power of community engagement in other Living Streets schemes. Officials, during the initial meeting in May 2025, indicated that councillors welcomed UCD to the team, with the former senior engineer describing it as *“perfect timing”*. DLR, understanding the sentiments of the general public in Dundrum, *“locals in Dundrum feel like they are being left behind”*, employed UCD’s leading experience in spatial mapping because of their interest in *“methods and tools that help people talk, understand one another, and find cohesion. In particular, tools that support the public in better understanding the challenges and the interventions to be implemented. The question is not if these interventions will happen, but how, which is why collecting community input is so important.”* Furthermore, the local authority would benefit from climate assessments and simulations based on the value added through this process.

While the results of DbD look promising, important factors might limit the deployment of the full potential of digital tools in encouraging citizen participation. Those without tech literacy are limited in the knowledge and capability to add inputs. Researchers aimed to mitigate this by employing traditional methods to supplement the digital approach, including public talks, flyer distribution, street engagement with a banner, one-to-one meetings with community members and drop-in sessions. The interpretive nature of Meitheal may also cause slightly inaccurate results when interpreted by researchers. Meanwhile, low participation numbers in the initial Knowledge-Gathering Phase (16 community members at the Godesign workshop) ultimately may have promoted partially biased or inefficient ideas for community voting, with topics skewed towards issues raised only by minor yet active groups. Further research and methods can explore pairing technological and traditional approaches to create a holistic picture, boost early participation numbers and include extended deadlines where any type of community member can provide input when the project receives public credibility and trust.

In conclusion, leveraging multiple types of digital technologies provides possibilities for encouraging co-production of knowledge, co-design and co-creation. The DbD initiative highlights that a sound structure, interoperability and transparency can promote the snowballing of community inputs between various platforms and phases. This, in turn, ideally encourages citizen participation and provides a solid base for a just climate transition. Moreover, the DbD workflow offers other institutions and researchers a replicable yet adaptable model. By applying this multi-faceted technological approach to urban design, local authorities and communities are better equipped to imagine and shape the future possibilities of urban areas.

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