



Metacity Block Edition

Modular Digital Twin for practical ‘what-if’ case scenario demonstrations and city planning

What happens if you combine urban planning, Minecraft and OpenTTD?

Our idea

A local digital twin (DT), sometimes known as a Smart City digital model, is a digital representation of a city's physical assets. Using complementary data, sensors, and data analytics, digital twins are updated along with their physical equivalents. With enough data and the addition of machine learning and statistical modeling, DTs can be used not only as a monitoring tool to describe the city as is and its historical records but also as **a simulation sandbox**. The possibility for testing of hypothetical scenarios or future plans to structure or policy, makes DTs a valuable tool to better inform policy and urban planning decision-making.

While a well-designed DT is an incredible asset for city development, due to the complexity of real-world cities, to provide value to city stakeholders, the DTs are usually extremely custom tailored, resulting in a narrow scope of simulation options. The value of such DT is therefore limited to only a few domain experts, and the introduction of a ‘what-if’ scenario to an existing DT by a non-expert ranges from costly to impossible.

We know that many municipalities, policymakers and citizens alike each grapple with their ideas of what makes a city safe, prosperous, and enjoyable to live in but lack the tools to bring their ideas to discussion. While DTs are great monitoring tools, due to their complexity, it is very difficult to project hypothetical change and show the difference in a meaningful and

objective way. We believe that in order to open the discussion around city planning to a broader scope of experts and even the wider public, we must overcome the domain expert barrier and equalize the access to a digital-twin-like visualization and simulation tool first. As we acknowledge that the trade-off between accuracy and input data quality with domain experts' insight will be significant, we propose such a tool must focus on ease of use and interpretability above all else. With that in mind, we propose a set of tools and methods for utilizing a *modular* DT to educate about the concepts of urban design and city planning and to showcase innovative ideas in the process.

We propose modularization of the smart city DT into connected but separate blocks, based on existing infrastructure and urban neighborhood patterns. We utilize these blocks as building components that form a DT, rather than a set of intertwined layers or a convoluted and immutable city net. In the modular DT, each block can be subject to change, which results not only in different visuals, but also impacts other factors i.e. energy consumption, emissions, or commute times for residents in the area. This brings a significant level of gamification to the process of city planning and opens doors to visionaries who want to effectively demonstrate their ideas in a simple but impactful way.

Our plan for development

Our project at this stage is operational as a digital twin. As of today, our system allows us to share and overlay data in a 2D and 3D space. In our DT we can also display dynamic data and have experience with simulating and visualizing the results of citizen's daily commute. **We also have a working module that transforms any selected area to a LEGO model, with tweakable resolution.**

To fulfill our idea we need to:

- Robustly assign city objects and their features into categories.
- Provide visualization with emphasis on one area of interest (commute, green spaces, noise, dust levels, temperature and so on).
- Establish neighborhood patterns capturing the local environments.
- Allow users to update a chosen neighborhood and explore the effects of their ideas.

Finally we want to further investigate the relationships between available data and our more abstract model and come up with new metrics and dependencies to visualize. As we expect the final phase to be very data dependent, we propose to work closely with data providers across multiple cities and countries to develop our product in a robust manner.

Limitations

Our models depend on the linking and analysis of heterogeneous data. Unfortunately, city data is spread across different organizations and systems in isolation without common semantics and technology base. This problem will only become more exacerbated in a digital twin that is designed to receive and model data collected from cities across the globe, as our platform is not limited to a single city.

We propose to solve this problem gradually, starting with the simplest data sources and focusing on the universal usability first rather than complexity. Due to this gradual progress

in the early stages our modular DT will have limited simulation value due to the initial lack of data and modeling venues.

Our team and practical relevance for the 3D community

Metacity, a small collective of engineers and digital artists, links technologies, data and design in order to create digital products in the form of data visualizations, web applications or complex custom tailored solutions. Our focus is on the processing and visualization of urban data.

We work with a broad variety of data and data formats in the 3D space. Therefore we strive to make our product functional with any and every open data source we come across and hope to champion the spirit of openness in the community. While it's not the primary purpose of our software, by design it can be used as a conversion and exporting tool for creatives who want to use the city or its parts (modular form or not) in their own 3D work.

In respects to Unreal Engine we are focused on providing high quality real-world data for UE navigation and AI agents simulation frameworks.

Our product is open-source, and as such, all the tools we continue to develop are free to use by the community.

Finally, we believe our product can open the opportunities for collaboration in the field of urban design and bring out a new avenue for discussion.

Read more (and join us) at our GitHub: <https://github.com/MetacitySuite>