Cognitive City Twins: Digitizing the Built Environment J. Andolina, D. Shin, P. Dang, G. Agarwal, H. Shou, S. Nguyen, D. Lin, G. Alruwais, G. Vindiola, N. Smith



Introduction

The Cognitive City Twin (CCT) is a UE5 planning tool built to visualize, analyze, and simulate digital to-scale city twins from diverse data sources such as shapefiles, drone scans, and real time IoT data. CCTs can be used for simulations of natural disasters, emulations of real time events in the city, visualizations of urban developments, and many other uses. CCTs have transformative potential for real estate developers, urban planners, and even for local citizen engagement. If the potential is realized, the CCT can both make city and urban planning more interactive and immersive, and enable any citizen to better understand their city and new developments/policies. The CCT revolutionizes how we can manipulate immersive technologies to make city data approachable, digestible, and accessible.





Approach

Our CCT is built in Unreal Engine 5 from georeferenced drone scans, Cesium/Google Earth satellite imagery, and user-created buildings. We populate this vast digital twin with Shapefile formatted datasets from public city archives overlaid with real-time IoT data collected by UC San Diego, enabling us to analyze these datasets both visually and spatially from within virtual reality.

For users to populate our digital world with buildings and artifacts, we created a modular building system that improves on Unreal Engine's existing modelling tools, with a focus on making building fun, interactive, and collaborative. Our goal is to use these models and integrated datasets to simulate and visualize our city's function, paving the way for a smarter, greener city.









 \rightarrow City planning, urban design simulation, policy making & communication, real estate development, property modeling, IoT real time building operations monitoring, and surveillance.

We have begun development on three CCTs to date: UCSD, the Hollywood Vinyl District, and West Chula Vista. The UCSD CCT demos realtime importing of campus busyness data. The Hollywood Vinyl District exhibits our modular building system which enable users to efficiently digitize its built environment. Finally, the Chula Vista CCT visualizes a buildout analysis with imported shapefiles, an analysis fundamental to both real estate developers and urban planners. The graphics below show just a couple applications of CCTs for property modeling in real estate and urban space simulation for developers, planners, and designers.





With a focus on increasing realism and fidelity, we intend to add more layers of data such as meteorological data (temperature, precipitation, ...), letting us simulate how our cities respond to various weather conditions. We want to lean more into our modular building system, creating higher fidelity models and interiors for enhanced photorealism and accuracy down to the slightest detail.

We look forward to expanding our CCT applications as simulations, acting as a medium for officials, planners, and designers to experiment with new approaches, ideas, and systems; with user-friendly interfaces enabling a smooth and seamless experience.



UC CYBER-ARCHAEOLOGY

Applications

Site at Sixth & Pennsylvania, San Diego

