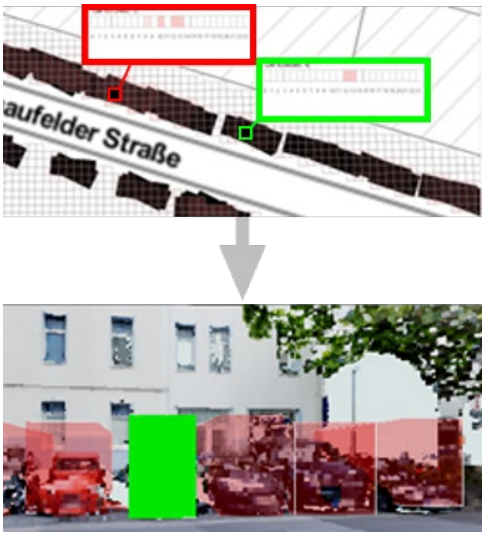
Interactive Visualization of Parking Occupancy over Time in a 3D Urban Digital Twin Web Application.

Master thesis at ikg (language: EN)

Introduction



In today's rapidly growing urban environments, efficient parking management has become a crucial challenge. As cities expand, the demand for parking spaces increases, making it essential to monitor parking occupancy in real-time or over time. Integrating this information into modern virtual 3D models of real-world cities (urban digital twins) provides an effective way to visualize parking space availability, helping reduce congestion and optimize urban mobility.

However, the challenge lies in effectively visualizing parking occupancy within a 3D urban model. Unlike traditional 2D maps, 3D visualizations offer a more immersive and detailed perspective, but conveying time-dependent data—such as parking space availability at different times—within this context can be complex. Traditional 2D visualizations often use color codes or simple markers to represent occupancy status, but translating this into a 3D environment requires developing an intuitive system that allows users to interact with both the spatial and temporal dimensions of the data. The goal of this thesis is to design an interactive and user-friendly visualization approach that presents parking occupancy information in a way that allows users to explore both current occupancy states and historical data within a 3D urban digital twin.

Tasks

1. Review relevant literature and existing temporal data visualization methods.
2. Create a 3D scene of an urban environment.
3. Develop an interactive approach for visualizing parking occupancy information in a specified point of time or time period.
4. Evaluate the results through a user study.
5. Write the documentation and final report.

Resources

3D voxel occupancy grid with the color, object and car observation time information.

Requirements

- Programming language, such as Python.
- Web development basics (HTML, CSS, JavaScript) for Three.js library utilization to create 3D scenes and visualization approaches in a web.
- Knowladge of WebGL Shader Language (GLSL) will be a greate benfit.

Contact

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