Chair of Computing in Civil and Building Engineering
TUM School of Engineering and Design
Technical University of Munich

Modeling:
Mathematics:
Programming:
Science:

Software Lab:

BIM2SceneGraph

Description

This project aims to develop an automated data generation system that enables the construction of paired scene images and corresponding scene graphs through interactive exploration of IFC-based BIM models. The system systematically constructs multi-granularity scene graphs (ranging from building and spatial structures to individual elements and geometric components) and links them with camera views captured inside BIM environments. By explicitly associating camera viewpoints with visible graph entities and their metadata, the system supports the creation of vision-aware graph representations that can be reused across different downstream tasks, including visual reasoning, agentic BIM systems, and multimodal learning, without being tied to a single predefined dataset.

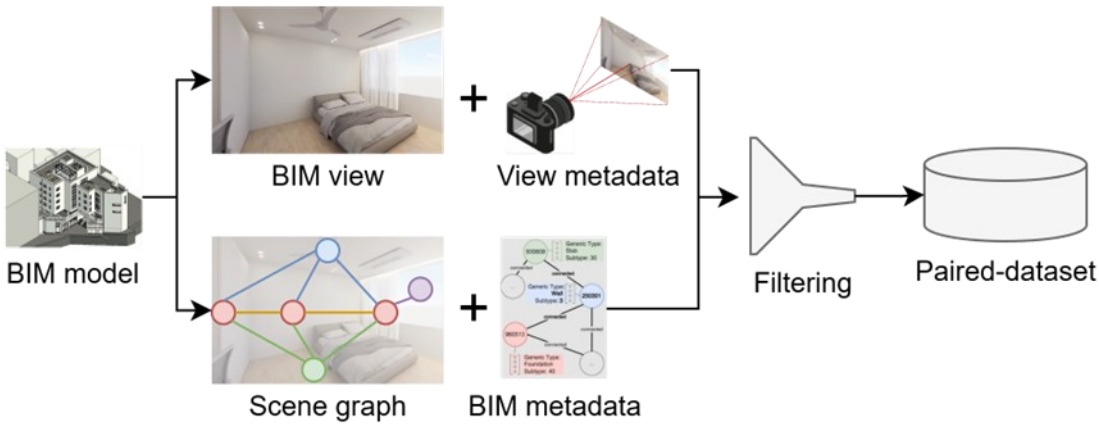

Figure 1. BIM2SceneGraph

Task

All processes in this project must be IFC-based, and IFC GlobalId shall be used as the primary identifier for graph nodes to ensure stability across model updates. Every generated artifact (including scene graphs, camera views, and labels) must be reproducible, with explicit metadata describing coordinate systems, units, camera parameters, and processing configurations.

GENERAL INSTRUCTIONS:

- **WP1. IFC-BASED SCENE GRAPH CONSTRUCTION:** Construct multi-granularity scene graphs from IFC BIM models with stable identifiers and extensible schemas.
- **WP2. VIEW GENERATION AND VISIBILITY-AWARE LABELING:** Generate camera views inside BIM environments and link them with actually visible scene graph nodes.
- **WP3. DATASET ASSEMBLY, SAMPLING, AND QUALITY CONTROL:** Assemble image–scene graph pairs into a reusable dataset with defined sampling rules and quality checks.
- **WP4. USER INTERFACE AND DATA GENERATION CONTROL:** Provide a unified interface to configure, control, and monitor the entire data generation workflow.

WORK PACKAGE (WP)	Key Deliverables
WP1. IFC-BASED SCENE GRAPH CONSTRUCTION	• IFC-to-scene-graph construction module • Multi-granularity graph schema definition (Building–Storey–Space–Element–Geometry) • IfcRel-based and user-defined edge generation logic • Node metadata extraction from IFC property sets
WP2. VIEW GENERATION AND VISIBILITY-AWARE LABELING	• Camera navigation and view capture module • Visibility-aware view–node linking data • Camera metadata records (pose, FOV, clipping planes) in global coordinates • Image outputs aligned with scene graph identifiers
WP3. DATASET ASSEMBLY, SAMPLING, AND QUALITY CONTROL	• Image–scene graph dataset format specification • Sampling rules for feasible view selection • Automated quality control and validation reports • Dataset-level statistics and coverage summaries
WP4. USER INTERFACE AND DATA GENERATION CONTROL	• User interface for configuring graph construction, view generation, and sampling criteria • Real-time feedback on view quality and data feasibility during capture • Workflow configuration and control module for data generation • Reproducible data generation presets and configuration profiles

Supervisor

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