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## Methods and Systems for Annotating Floorplans

Tech ID: 34353 / UC Case 2019-746-0

### BACKGROUND

Traditional approaches to indoor mapping relied heavily on manual floor plan tracing or rule-based computer vision algorithms, which proved fragile when confronted with the wide variety of graphical representations used in architectural drawings. While Computer-Aided Design (CAD) floor plans in formats like DWG or DWF exist for most modern buildings, these detailed technical drawings are typically proprietary and inaccessible to the public. Mappers often work with low-quality images (JPEG or PDF format) of floor plans, necessitating manual digitization processes. RGB-D cameras, which capture both color and depth information, emerged as promising tools for 3D indoor scanning, though they face limitations including restricted range (typically less than 5 meters), sensitivity to lighting conditions, noisy point clouds at object edges, and computational demands for real-time processing. Automatic floor plan vectorization algorithms remain highly sensitive to image quality and graphical symbol variations, often requiring substantial manual editing even with state-of-the-art deep learning approaches.

### TECHNOLOGY DESCRIPTION

To help address these challenges, researchers at UC Santa Cruz (UCSC) developed Semantic Interior Mapology (SIM). SIM's Map Conversion Toolkit's grid-based tracing interface shifts away from the more traditional corner-detection methods which fail on high-definition floor plans with thin interior walls and long exterior walls. Users first define horizontal and vertical grid lines that overlay wall segments, then selecting intersections as corners, the system ensures co-planar walls are represented by perfectly aligned collinear segments, which is a major improvement over manual drawing tools like Google My Maps or Mapbox Studio that result in connectivity errors and misalignments. SIM's ability to handle diagonal walls through "ghost wall" lines while maintaining computational efficiency distinguishes it from methods requiring complex geometric preprocessing. SIM's Map Population Toolkit's semi-automatic workflow for extracting furniture and fixtures from RGB-D scans addresses a fundamental gap, as most floor plans lack small-scale interior features. The toolkit's mesh orientation algorithm helps to overcome geometric distortion problems inherent in consumer-grade RGB-D cameras by using histogram analysis of normal vector angles combined with rectification through collineation transformation. The integration of superpixel generation for identifying planar surface patches on 3D meshes, combined with a web-based interface for manual object selection, creates an accessible workflow that non-experts can use without specialized training. Moreover, SIM's end-to-end conversion from floor plan images to geo-registered GeoJSON files that can be rendered interactively in 3D using standard web tools like Mapbox GL JS.

### APPLICATIONS

- ▶ real estate and property management
- ▶ accessible / assistive navigation
- ▶ facility management, smart buildings

### FEATURES/BENEFITS

- ▶ Aligns co-planar walls and eliminates geometric errors common in freehand drawing tools, reducing floor plan vectorization time from hours to minutes while maintaining architectural accuracy.
- ▶ Corrects RGB-D camera scanning artifacts that cause walls to appear non-planar or non-orthogonal for more accurate 3D object registration even with consumer-grade sensors that have 12°+ alignment errors.
- ▶ Transforms static architectural drawings into accessible navigation aids for visually impaired users which can enable independent wayfinding in complex buildings through smartphone-based audio guidance.

### CONTACT

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### INVENTORS

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### OTHER INFORMATION

#### KEYWORDS

3D, 3D interactive, building interiors, building mapping, building maps, indoor mapping, indoor maps, RGB-D, depth-sensing camera, annotating floorplans, floorplans, geojson, mesh, floor plan, architectural

#### CATEGORIZED AS

- ▶ **Communications**
  - ▶ Internet
  - ▶ Wireless
- ▶ **Computer**
  - ▶ Software
- ▶ **Imaging**
  - ▶ Software
- ▶ **Transportation**
  - ▶ Other
  - ▶ Personal

#### RELATED CASES

2019-746-0

▶ Creates interactive 3D indoor maps viewable in standard web browsers without proprietary software, enabling real-time updates and integration with location-based services at contemplated lower cost than commercial solutions.

## INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	<a href="#">11,367,264</a>	06/21/2022	2019-746

## RELATED MATERIALS

### ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Camera-Based Reader for Blurry and Low-Resolution 1D Barcodes](#)
- ▶ [Using Virtual Tile Routing For Navigating Complex Transit Hubs](#)
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