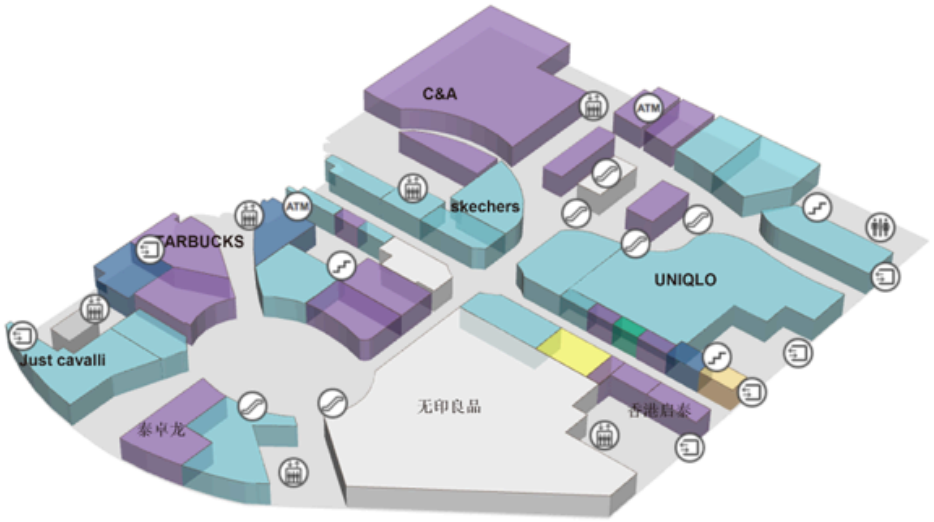
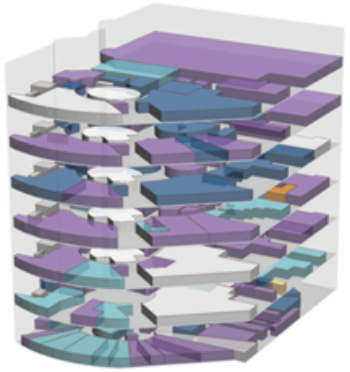




Indoor3D: A WebGL Based Open Source Framework for 3D Indoor Maps Visualization

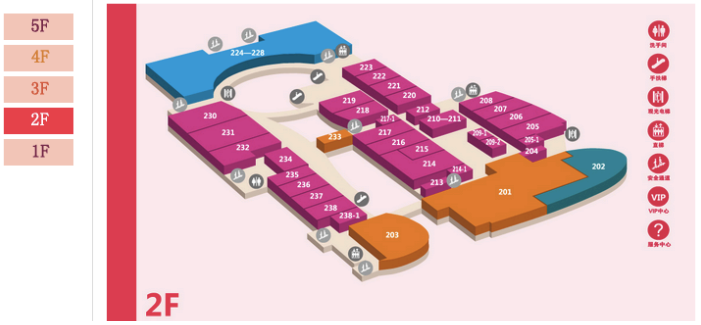
Meng Gai, Guoping Wang
Peking University

Outline

- Motivation and Backgrounds
- Our Design
- Algorithm
  - Best view generation
  - Progressive visibility of elements
- Results
- Future Work
- Conclusion

Motivation

Indoor maps are widely used in shopping malls, airports, subways, etc.

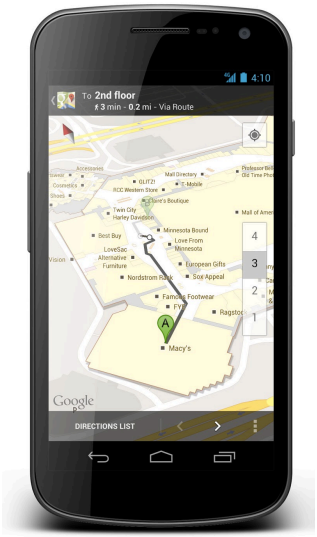


Related work

As far as we know there has not been any open source indoor map visualization framework.

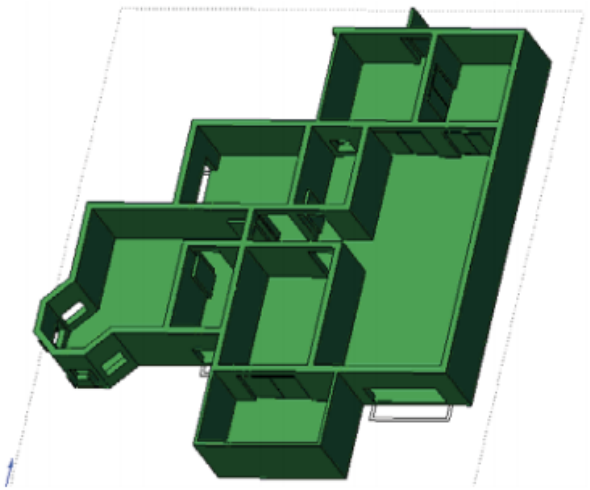
Commercial services:

- Google indoor map
- Amap (Gao De)
- weiditu



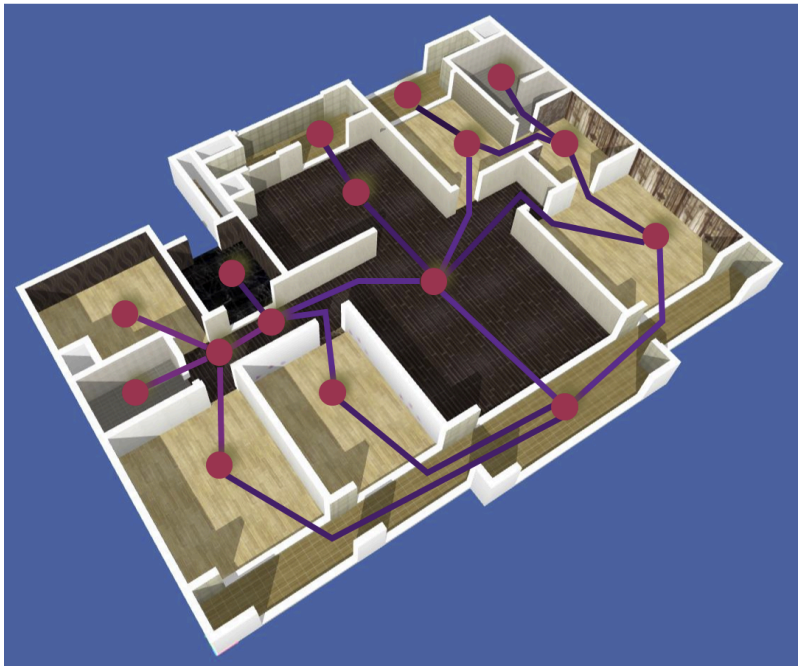
Related work

Reconstruction from 2D Floor Plans [Lewis and Sequin 1998] [Zhu et al. 2014]



Related work

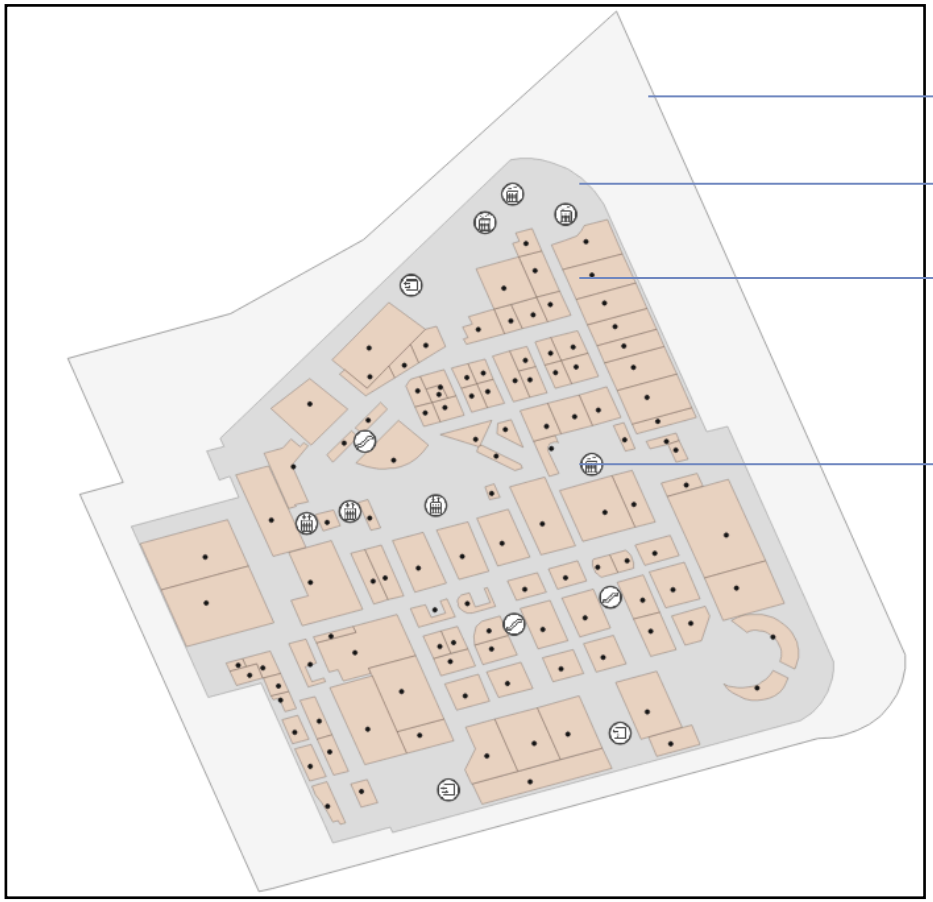
- indoorGML: A candidate OGC standard for an open data model and XML schema for indoor spatial information.



Our Design

- Web based
- Simple data format for network transmission
- Easy to use and be customized by developers

Data Structure



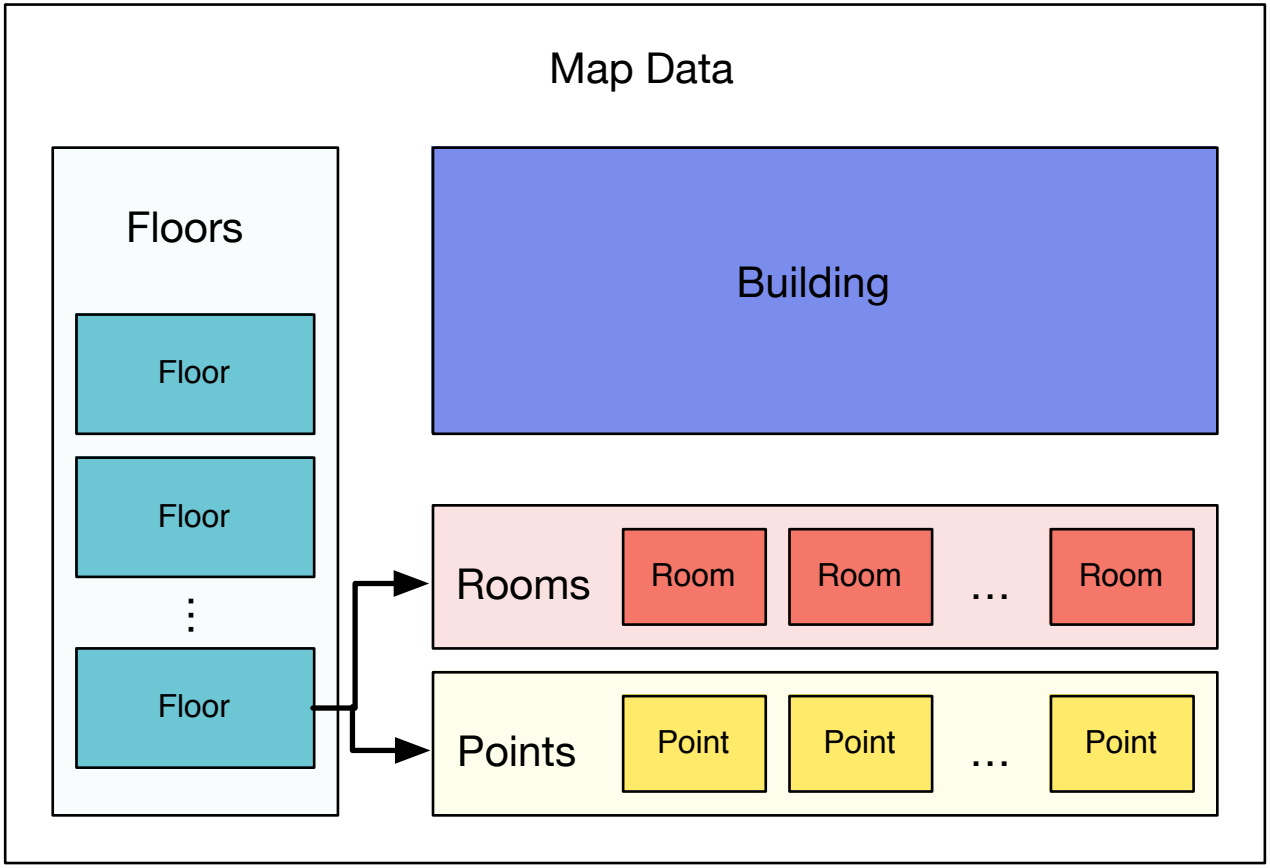
Building

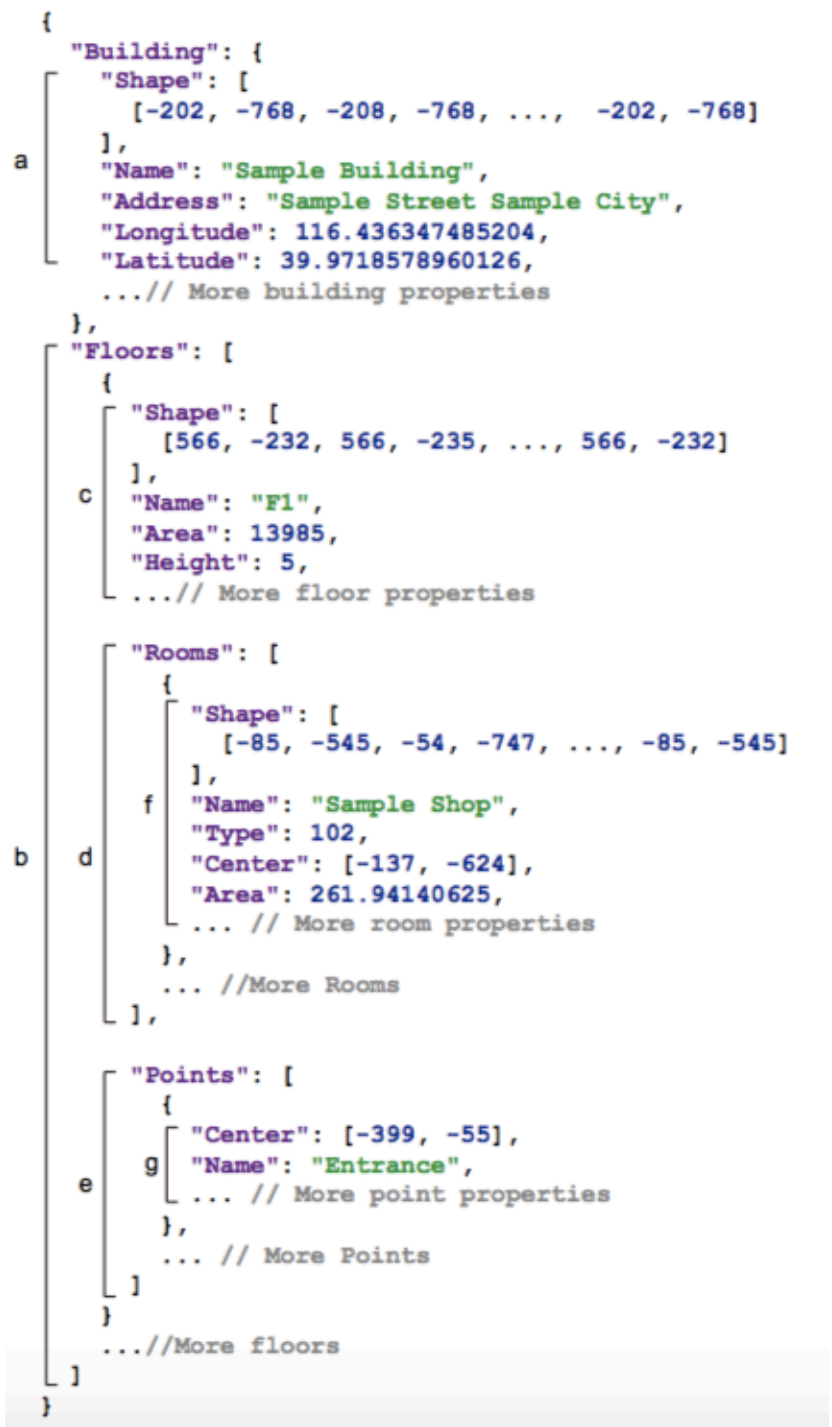
Floor

Rooms

public facility spots

Data Structure



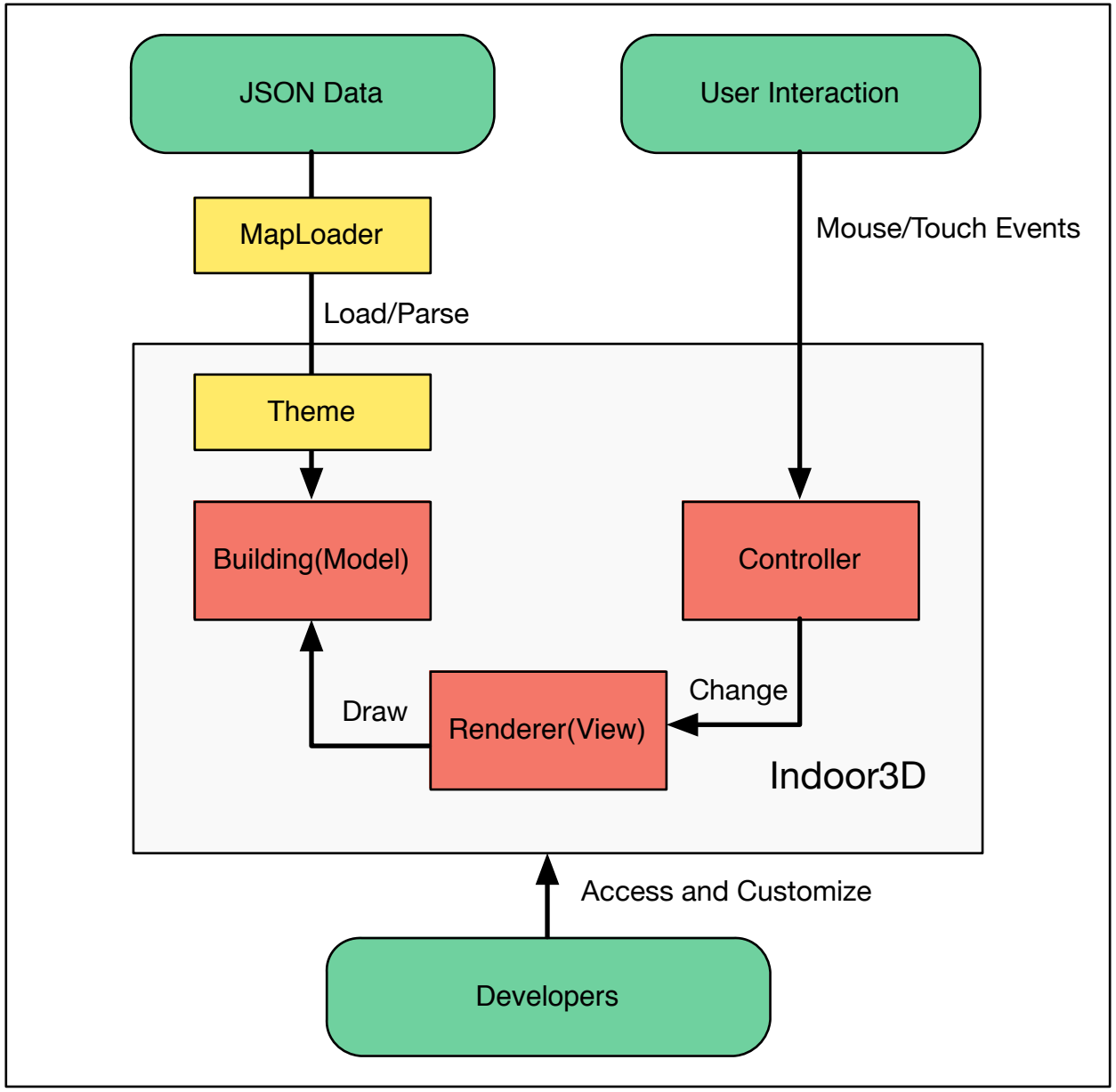


The original JSON file is usually less than 1MB.

Architecture

MVC based architecture

- Model: The building's data
- Renderer: WebGL or Canvas Renderer
- Controller: Handling user interactions


JSON Data
User Interaction
MapLoader
Mouse/Touch Events
Load/Parse
Theme
Building(Model)
Controller
Draw
Renderer(View)
Change
Indoor3D
Access and Customize
Developers

Usage

```
<script>                                                    a
      var indoorMap = Indoor3D();
      indoorMap.load("sampledata.json");
</script>
```

Usage

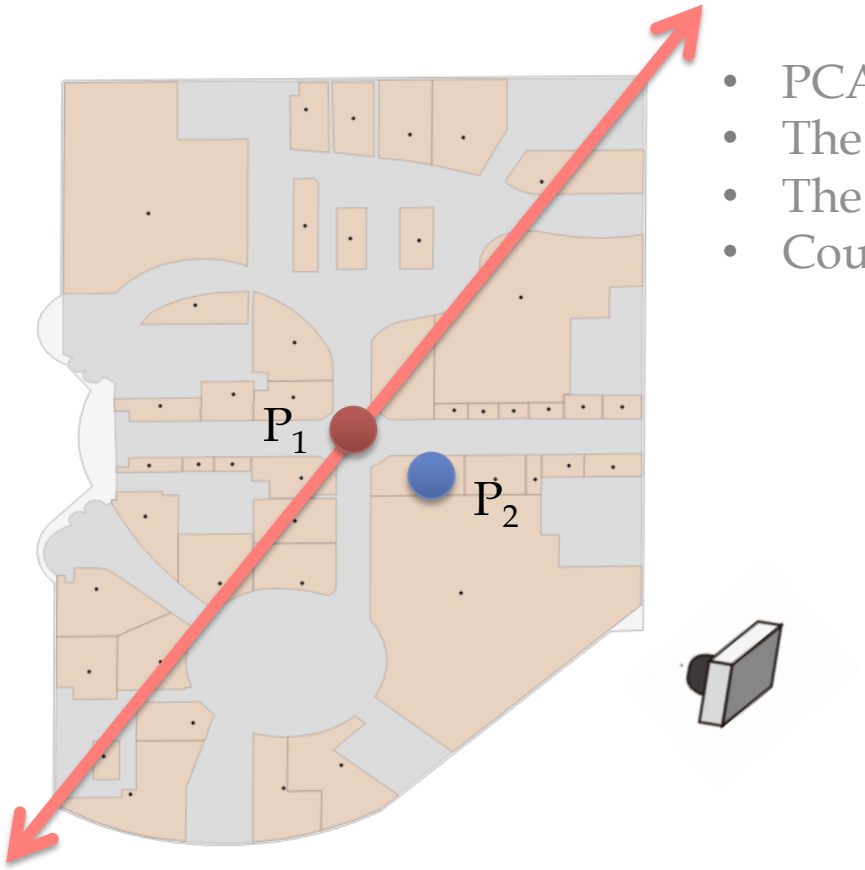
```
<div id="indoor3d"></div>
<script>

    var params = {
       mapDiv:"indoor3d"
    }
    var indoorMap = Indoor3D(params);

    indoorMap.load("sampledata.json", function(){
        indoorMap.setSelectable(true)
                 .showRoomNames(false)
                 .setSelectionListener(callback);

        var ul = Indoor3D.getUI();
        document.body.appendChild(ul);
    });
</script>
```

Best View Generation

Selecting the best views for 3D object has been well studied, especially in the CAD field. [Mortara and Spagnuolo 2009]. [Fu et al. 2008] [Hu et al. 2011]

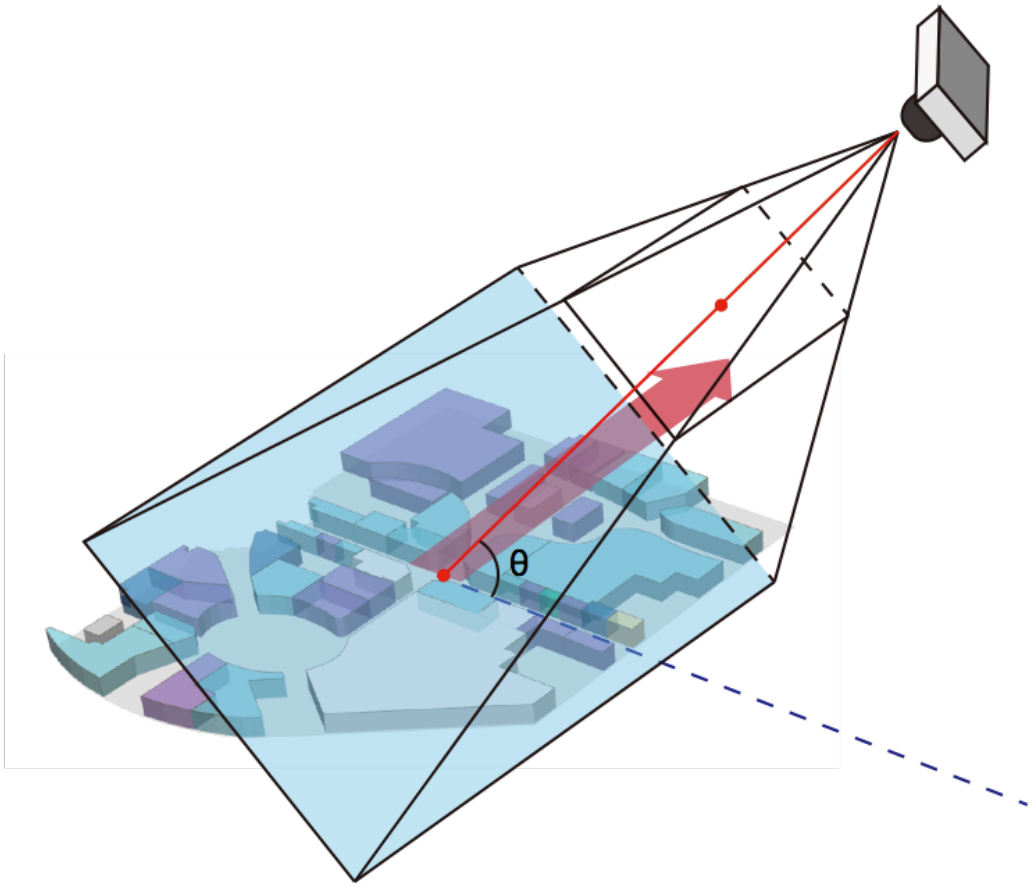
The main idea: maximize the visibility of visual features

Best View Generation

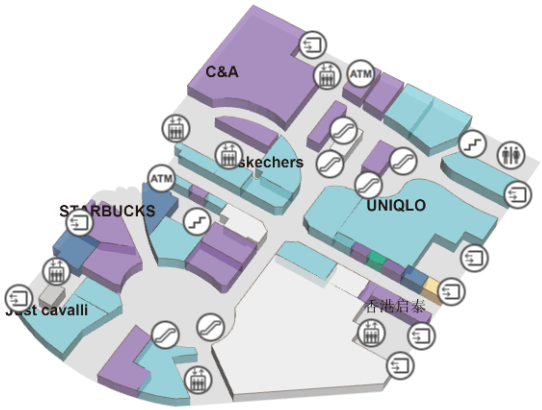


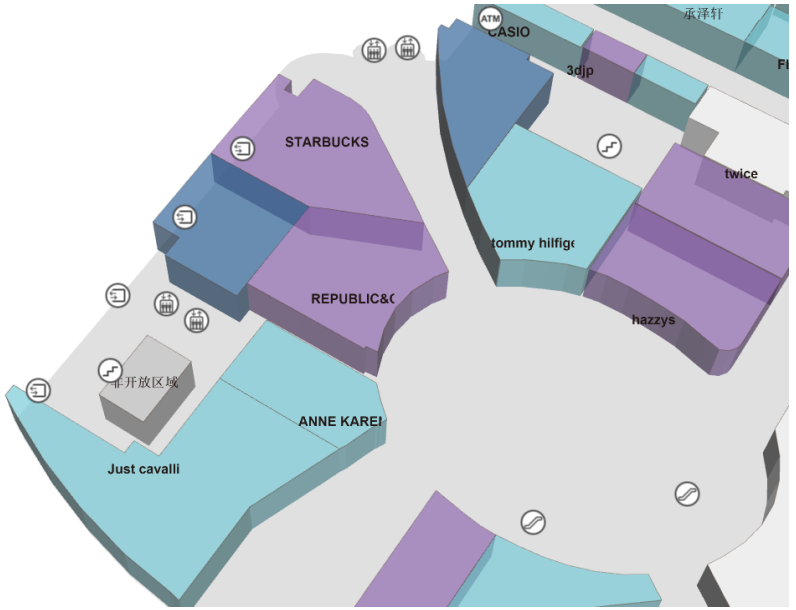
- PCA (Principal components analysis)
- The center of the floor's boundary P_1
- The average center of the rooms P_2
- Count the result of all floors

Best View Generation



Progressive Visibility of Elements





Progressive Visibility of Elements

$$P_i = w_1 \frac{S_i}{S_{max}} + w_2 \frac{Pop_i}{Pop_{max}}$$

Area

Popularity

Progressive Visibility of Elements

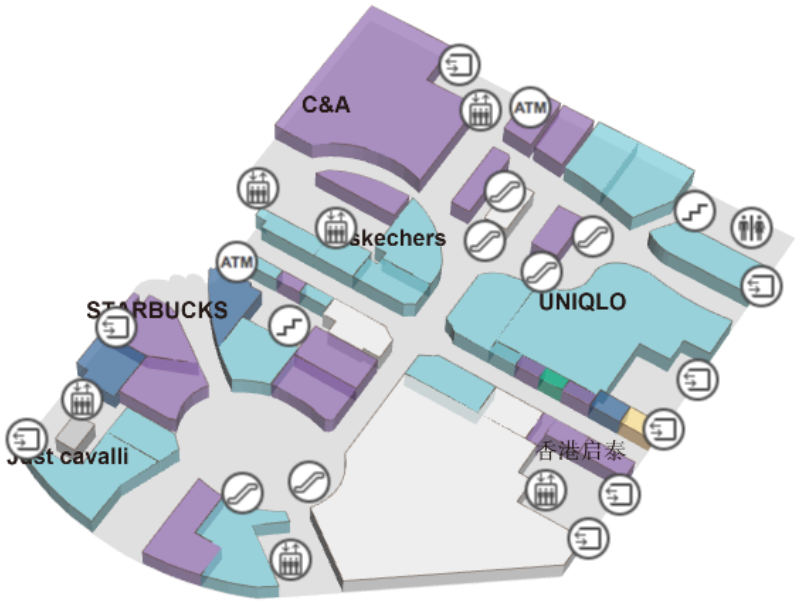
Add a margin to avoid the flicking effect

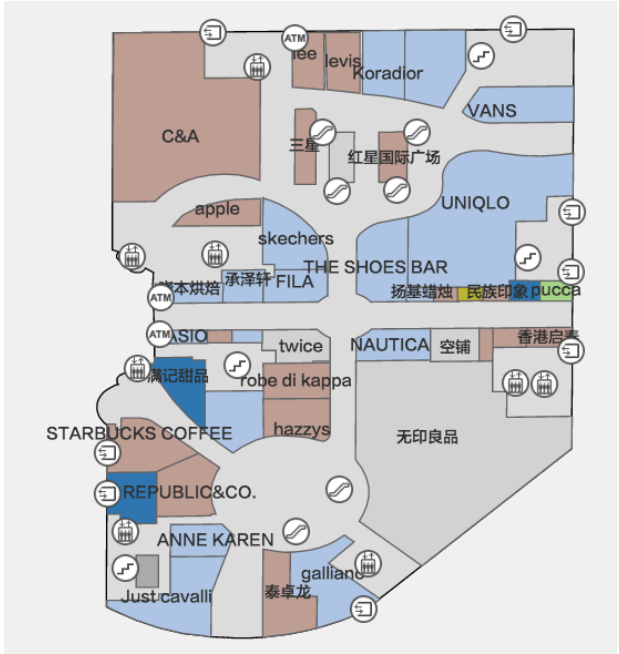
Algorithm 1 decide the visibility of elements(texts and icons)

```
sort the element by descending priority order
for i = 1 to elements.length do
    visibility ← true
    margin ← 5
    for j = 0; j < i; j++ do
        recti ← elements(i).boundingRect
        rectj ← elements(j).boundingRect
        if elements(j).visible and recti.collide(rectj) then
            visibility ← false
            break
        end if
        recti.shrink(margin)
        rectj.shrink(margin)
        if elements(i).visible ≠ true and recti.collide(rectj)
        then
            visibility ← false
            break
        end if
    end for
    elements(i).visible ← visibility
end for
```

Results

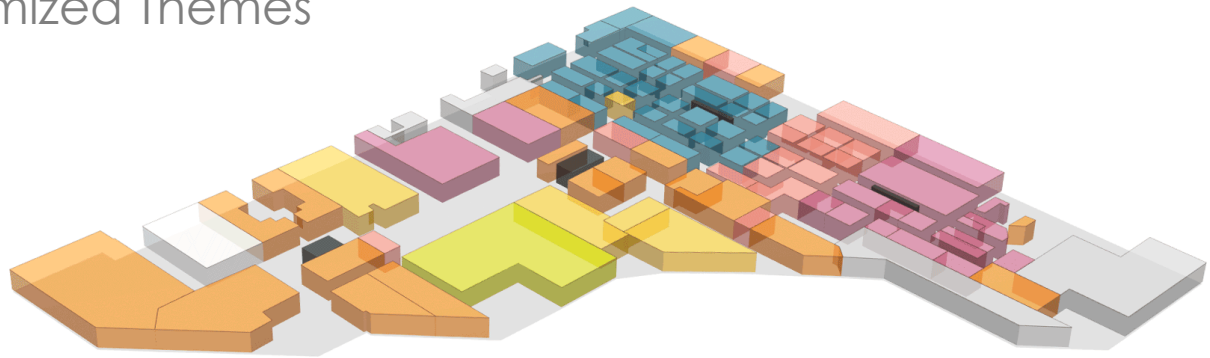
- Three.js for WebGL Rendering
- HTML5 canvas for 2D backward compatibility

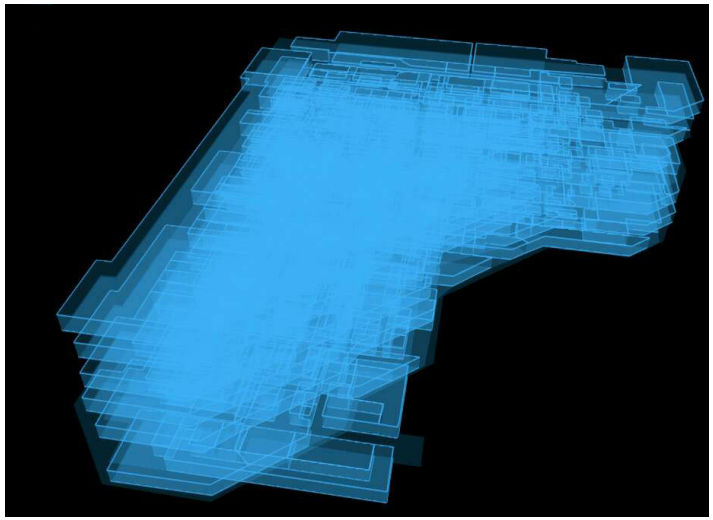


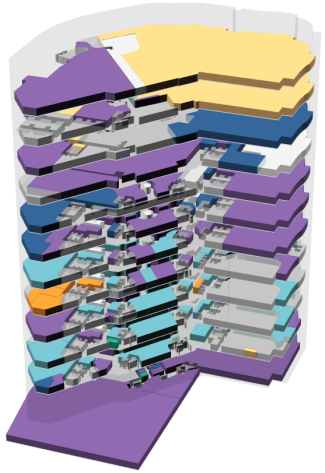


Results

Customized Themes

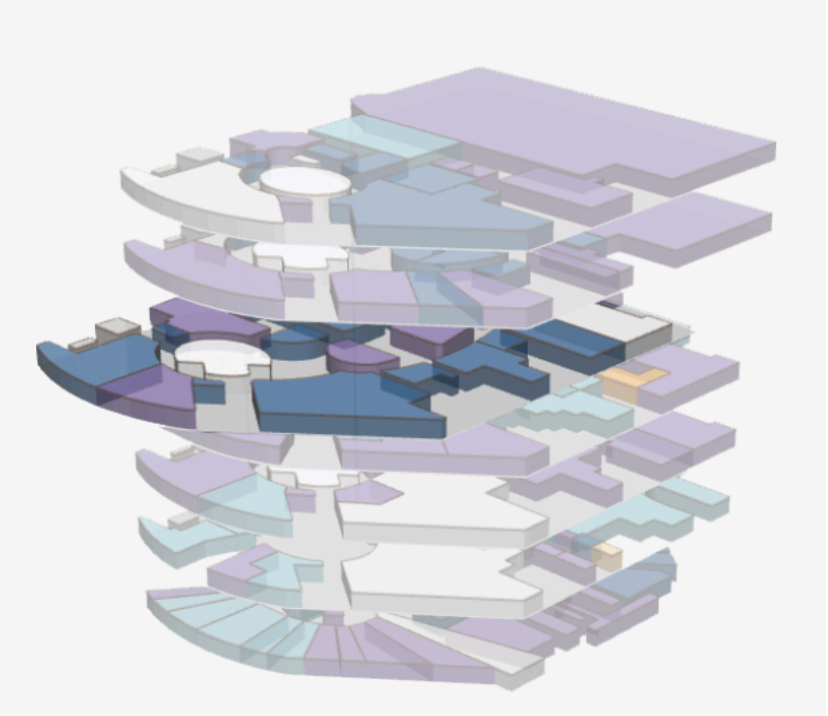


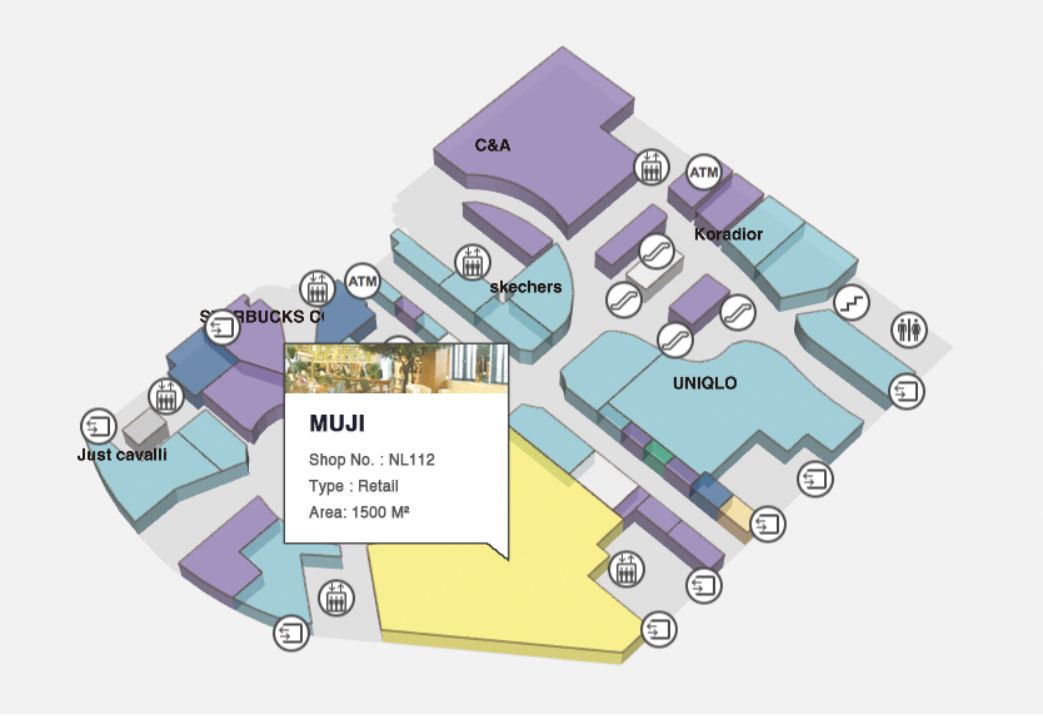




Results

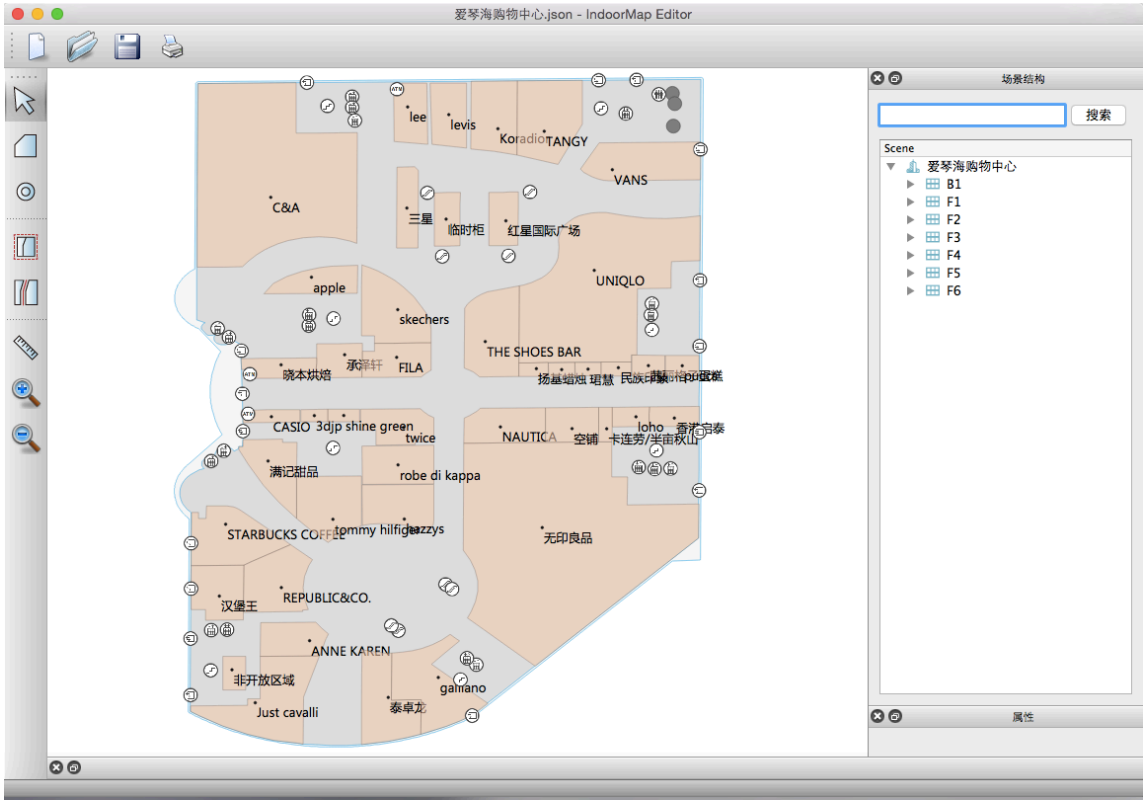
Customized Interactions





Future Work

- Location registration & navigation functions
- Tools for acquiring the map data



Conclusion

- In this paper we presented our Indoor3D framework.
- It takes advantage of WebGL to render 3D indoor scenes.
- We designed a JSON file to store the map structure.
- We solve several problems sush as best view selection and progressive element visibility to achieve better user experience.
- The framework is designed flexible so that it allows the developers to customize it conveniently.

Thank you!

https://github.com/wolfwind521/indoor3D

Email: gaimeng@pku.edu.cn

Q&A