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3D space subdivision in IndoorGML

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Content

- Context of indoor navigation modeling
- Current sub-spacing concept in IndoorGML
- A bit more advanced sub-spacing framework
- Future improvements
Context

• How to provide guidance?
  o Geometry + Semantic ➔ Model
  o + Connectivity information ➔ Network
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More information = More possibilities
IndoorGML Spatial Structuring

- Not concerned about architectural components
- CellSpace
- Navigable / NonNavigable
- Multilayers
Sub-spacing in IndoorGML

- Basic/Native room subdivision

As described by the model designer
Sub-spacing in IndoorGML

- A step further: Refinement of the graph

Space 1 is cut into 2 pieces to improve its granularity
Sub-spacing in IndoorGML

- This can be done simply relying on geometric criteria

Criteria: $d/2$
Sub-spacing in IndoorGML

- ... or more complex combination: topology + semantic

Criteria: wall contact

Criteria: door contact
Indoor is more complex than that...

- Indoor spaces are often populated by objects and beings...
Indoor is more complex than that...

- How to *take this into account* in a navigation system? (meaning in the model and in the network)
Space subdivision: why?

- **Navigable / Non-navigable** spaces need to be identified.

- **Spatial Properties and functions** of the objects (resources) as well as the users (agents) need to be considered.
Advanced sub-spacing framework

- Flexible Space Subdivision (FSS) framework.

2 main principles:
- Indoor object-related: The objects tell us how to organize the spaces.

- Mobility of objects characterizes the space occupancy:
  - Static (S-objects) e.g. wall
  - Semi-mobile (SM-objects) e.g. furniture
  - Mobile (M-objects) e.g. human

Spatial subdivision of complex indoor environments for 3D indoor navigation. Diakité & Zlatanova, IJGIS, 2017
Advanced sub-spacing framework

- **Flexible Space Subdivision (FSS) framework.**

- **3 types of subspaces:**
  - Object spaces (O-Spaces) -> SM-objects
  - Functional spaces (F-Spaces) -> SM and M-objects
  - Remaining free spaces (R-Spaces) -> M-objects

Spatial subdivision of complex indoor environments for 3D indoor navigation.
Diakité & Zlatanova, IJGIS, 2017
Space subdivision: Functional Spaces
Space subdivision example

Original BIM model

Basic subdivision

Spatial subdivision of complex indoor environments for 3D indoor navigation.
Diakité & Zlatanova, IJGIS, 2017
Space subdivision example

Original BIM model

FFS subdivision

Spatial subdivision of complex indoor environments for 3D indoor navigation. Diakité & Zlatanova, IJGIS, 2017
Spatial subdivision of complex indoor environments for 3D indoor navigation.
Diakité & Zlatanova, IJGIS, 2017
Case study

Walkable area

Flyable space

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Can this fit to IndoorGML?

With some improvements, yes!
Future work

• We need to consider indoor occupancy in future models
  ➢ Combination of inputs can help: Point clouds, cameras, etc.

• More tools and developments are coming to make IndoorGML more accessible.

• Integration with outdoor models should also be considered.
Thanks

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