Multilayer of Ontology-Based Floor Plan Representation for Ontology-Based Indoor Emergency Simulation

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Abstract. We propose a multilayered ontology-based floor plan representation. It supports a study of indoor emergency via ontology-based simulation. Our approach uses ontology to model floor plan into various perspectives e.g., structure, accessibility. These perspectives are represented by multilayer of graphs. There are two main advantages in this model. First is capability of handling dynamic situation and consequences of emergency using ontology and reference rules. Second is the use of multilayered graph-based representation in describing how the simulation goes with the incident scenarios.

Keywords: Multilayered floor plan representation, ontology based modeling, emergency situation

1 Methodology

Modeling a floor plan with ontology is useful for sharing, reuse and meaningfulness. OntoNav [1] modeled a floor plan in navigation perspective. It is not enough for OntoNav to handle dynamic situation caused by incidents. This research wants to attack this issue. Ontology is used for capturing floor plan’s concepts in various “Perspective” classes. Other concepts such as classes of “StructureComponent”, “FunctionalRequirement” are also defined. Then we use this ontology and a set of reference rules in order to describe relationships among these perspectives and link them. We also use them in order to detect dynamic situations and consequences. Fig.1 shows some parts of our ontology design. To evaluate our proposed idea, we set up an example scenario as followed: “When an unexpected situation happens, a power control room cannot provide the electricity to any appliance and other places. Consequently, elevators cannot operate to any purpose, including use for escape purpose.” In this scenario, we can see how “PowerControl perspective” causes consequences on “Accessibility perspective.” Our method is not only able to deal with this kind of consequence, but also represent the current situation of the simulation with layers of graph. One
Fig. 1. Example of ontology design describing a floor plan.

graph represents one perspective. This lets us to notice what happens in which perspectives in a glance. It makes the monitoring of simulation result more convenient than text-based one. Our method overcomes the existing graph-based representation [2] which represented all perspectives with a single graph. Only a few perspectives may cause too overwhelming information to represent in a single graph. With this reason, our method is better to understand the situation.

2 Discussion and future work.

This work proposes a multilayer of ontology-based floor plan representation for ontology-based indoor emergency simulation. Ontology is used to capture a floor plan’s perspectives and to link relationship among them. Perspectives are represented by multilayer of graphs. From the scenario given in the previous section, our research shows two advantages — dynamic-situation handling and better representation. For the future work, we plan to use this idea concept to combine with human ontology and a simple simulation of emergency situation.

References
