Defining Smart Spaces as JSON Objects

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**MOTIVATION**

Testbed for IoT-based Privacy-Preserving PERvasive Spaces (TIPPERS) is a system designed to combine sensor data with information about an area, creating a semantically meaningful understanding of what is going on within an IoT smart space. This information can then be used by developers to create applications, such as location-based messaging and occupancy monitoring. As an IoT Data Management System, TIPPERS makes use of semantically meaningful information about a space, allowing for operations like path planning, computation of sensor coverage, and estimation of occupancy.

**SPACE HIERARCHY**

To gain a semantic understanding of a space, we need to develop a space hierarchy or tree, which shows how spaces are related to each other.

Bren Hall and Croul Hall are children of the UCI campus, which tells us that their extents are completely contained within the extent of UCI.

Based on the above space hierarchy, we know that if someone is in room 2601, they must also be within the extent of floor 2, and therefore must also be in Bren Hall.

**TIPPERS SPACE MODEL**

The TIPPERS Space Model presents a powerful tool for creating space hierarchies and using them to present developers with semantically meaningful information. However, this model requires input spaces to be represented as JSON files, which can be challenging to create by hand. Represented as a JSON object, the UCI campus takes up more than 42,000 lines of code.

Creating the necessary JSON files manually is extremely time consuming and prone to errors. To save time and avoid errors, we are building a graphical user interface to simplify the process of defining spaces as JSON objects.

**CONVERSION TO JSON**

![Diagram from a presentation by Daokun Jiang](image)

The tool we have created uses OpenStreetMap, React, and JavaScript to convert user input into a JSON file. This interface simplifies the definition of spaces as JSON objects, providing a more efficient and less error-prone input method for the TIPPERS space model.

**CONCLUSION**

The tool we have created uses OpenStreetMap, React, and JavaScript to convert user input into a JSON file. This interface simplifies the definition of spaces as JSON objects, providing a more efficient and less error-prone input method for the TIPPERS space model.

**Future Direction**

- Improve the tool to generate JSON objects from existing floor plans
- Develop efficient algorithms that utilize the power of the TIPPERS space model
  - Computation of topological relationships between spaces
  - Finding paths within a space
  - Translation between coordinate systems

**References**


Daokun Jiang. Hierarchical Spatial Ontology Model: Location model


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