Towards a Unified Model of Outdoor and Indoor Spaces

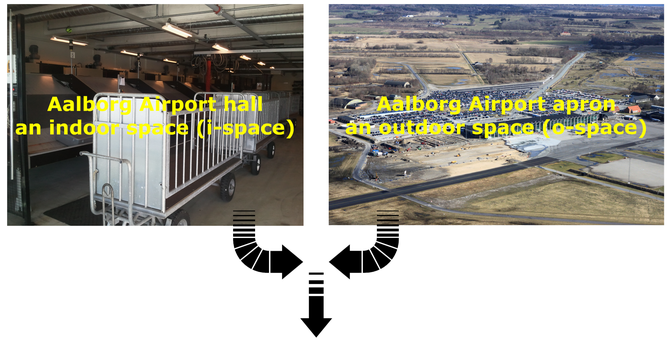
Sari Haj Hussein, Hua Lu, Torben Bach Pedersen

Introduction and Motivation

A variety of applications, facilitated by receptor-based systems (RFID-based and WSN-based), need to span seamlessly both outdoor and indoor spaces. The most fundamental of these applications is positioning, i.e., determining the location of a moving object in outdoor and indoor spaces (OI-spaces). Supporting this application and others, at various levels in OI-spaces, motivates the creation of a unified model.

This poster sheds the light on a unified model of OI-spaces and receptor deployments in these spaces. The model is expressive, flexible, and invariant to the segmentation of a space plan, and the receptor deployment policy. It is focused on partially constrained outdoor and indoor motion, and it aims at underlying the construction of future, powerful reasoning applications.

The OI-space Plans



a unified oi-space model

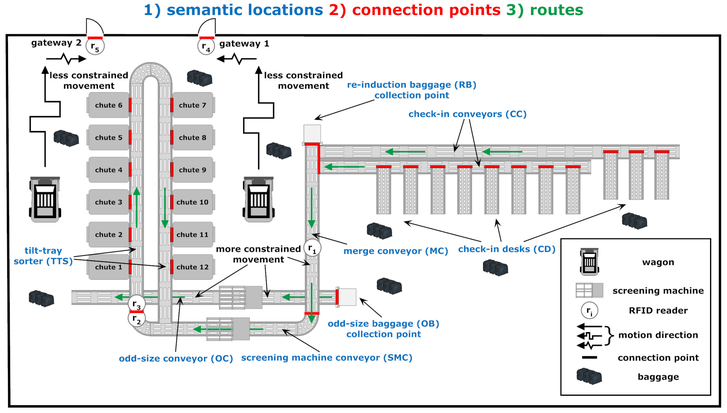
Grasping the Topology and the Dynamics

Semantic Locations: a location that has a meaningful interpretation to the RFID-based application.

Connection Points: an actual (movable/immovable) or virtual structure at which two or more semantic locations meet one another.

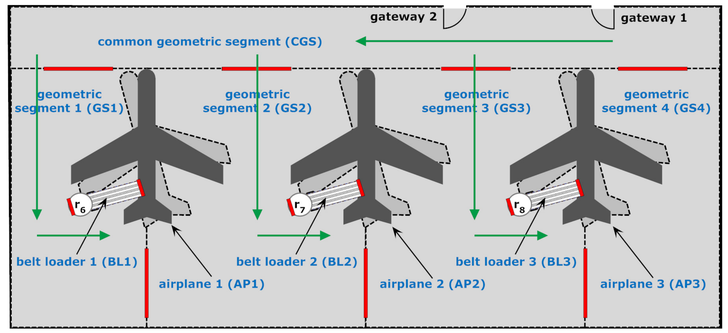
Routes: a particular way moving objects follow (or are carried over) between semantic locations.

1) semantic locations 2) connection points 3) routes



hall space plan

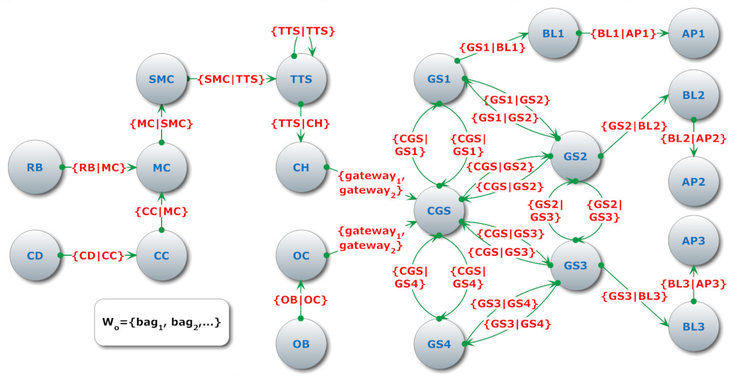
1) semantic locations 2) connection points 3) routes



apron space plan

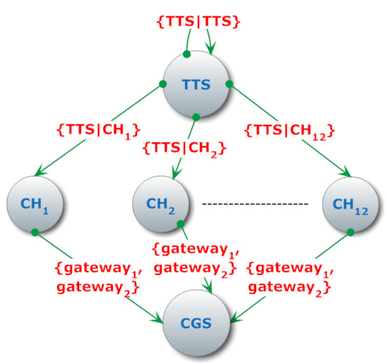
The Unified OI-space Graph Model

1) semantic locations 2) connection points 3) routes

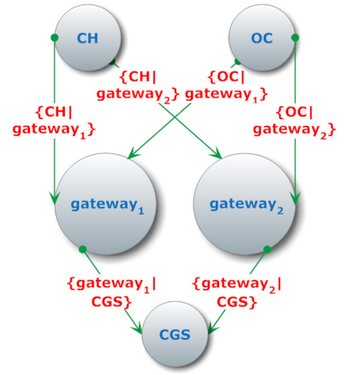


a unified oi-space model

Model Flexibility



flexible model



permit alternative interpretations

RFID Deployment Outdoors and Indoors

a unified oi-space model

3 guidelines

an RFID readers deployment model

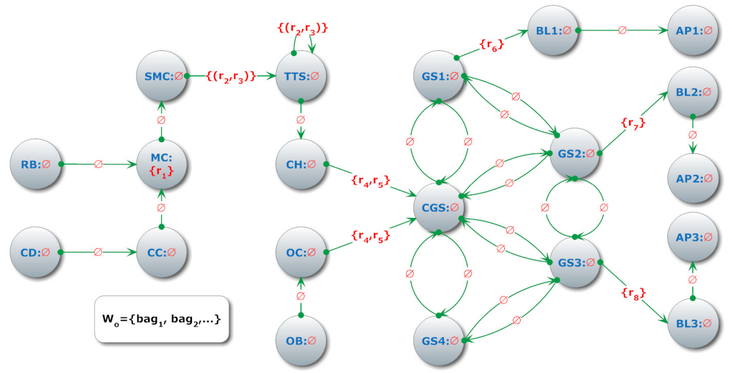
(1) If a reader is positioned inside a semantic location away from any connection point, then add this reader to the label set of this semantic location.

(2) If a reader is positioned at a connection point between semantic locations, then add this reader to the label set of the edges connecting these locations.

(3) If two readers are adjacently positioned at a connection point between semantic locations, then add these two readers as an ordered pair to the label set of the edges connecting these locations.

The RFID Readers Deployment Model

1) semantic locations 2) readers positioning 3) routes



an RFID readers deployment model

Acknowledgments

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