Logic-inspired Query Processing Framework for Ubiquitous Computing

What?
WE PRESENT a novel query processing framework, founded on model checking principles, that handles the query processing task of location-aware services. At its core is a modal logic-inspired language used to query existing symbolic location models.

Why?
CONTEXT MODELING has been an extensively studied topic within the ubiquitous computing community. As a result a great variety of models have emerged, most of them representing the information, and its underlying semantics, by graph structures. However none of these has been used as data models that can actually be queried.

How?
FORMAL METHODS are needed for assuring the soundness of the queries and their results, just like relational algebra guarantees the consistency and correctness of SQL queries over relational databases.

Model Checking provides well-founded mechanisms to query graph structures, but needs to be extended to cope with the requirements of location-aware services.

1- GRAPH DATABASE MODEL
• Containment relationship between places
• Entities within the environment are mapped to propositional variables

2- QUERY LANGUAGE EXTENDING MODAL LOGIC
• Nominals are propositional variables true at exactly one node in the state graph
• Access operator gives random access to any node

3- QUERY PROCESSING
A query is a satisfaction relation, connecting the hierarchical graph with the formula:
\[ G \models E(\downarrow_{\text{room}}\text{comp}) \]
returns all the rooms equipped with a computer.

Publications

Symbols:
- \( G \models \) satisfaction relation
- \( E(\downarrow_{\text{room}}\text{comp}) \) returns all the rooms equipped with a computer.