Context-Aware Interoperability:Application to the Path Finding Problem

Taboada-Orozco, Adrian*
CIAD UMR 7533
Univ. Bourgogne Franche-Comté, UB, F-21000 Dijon, France
*Corresponding author: adrian.taboada-orozco@u-bourgogne.fr

Yetongnon, Kokou
CIAD UMR 7533
Univ. Bourgogne Franche-Comté, UB, F-21000 Dijon, France
Kokou.Yetongnon@u-bourgogne.fr

Nicolle, Christophe
CIAD UMR 7533
Univ. Bourgogne Franche-Comté, UB, F-21000 Dijon, France
Christophe.Nicolle@u-bourgogne.fr

1 Abstract

To move autonomously inside of a built environment robots requires a set of sensors and software components. Thus,robots perceive their direct environment and act accordingly to move towards their desired destiny. A complete perception of the environment is information robots ignore. In consequence, the issue of finding an optimal pathway only rely on robots.The need of interoperability between the environment itself and its occupants is evident to build a relevant movement strategy. Beyond the aspect of immediate mobility, the question to be addressed is: how to optimize the movement of the robots by improving the time and processing constraints linked to the discovery of its environment?

We present a context-aware collaborative environment system named "Ontology for Interoperability Robot-Building" (O4IRB). The objective of this context-aware collaboration is to optimize all decisions that robots have to make by shifting certain reasoning to the building (reasoning about its topology, the physical constraints to be processed , the calculation of the best path and presence of its occupants). Then, building profits of a harmonic distribution of individuals to avoid overpopulation of its spaces. O4IRB is a cyberphyscial-ontolgy based system, that represents the context of physical spaces as well as inside parameters to articulate actuators and create an optimal pathway. This formal model makes causal reasoning rules possible to improve robots movement strategy and acts on building actuators. These lasts change dynamically the state of the building connections to make easier moving robots. Collaterally, the O4IRB system enriches its knowledge of building occupants. In our experiment the smart building knows its topology and has services to calculate a pathway from a source to a target space, as services to adapt the pathway to the profile of the robots and constraints on space connection (doors, elevator or stairs). The novelty of our approach is to reduce processing load and hardware of robots by adding a global perception and reasoning on mobility at the building level. Thanks to the ontology features, our system is extensible and, for example, will be improved by incorporating sensors such as smart cameras in robots and buildings.