GreenerBuildings

An ubiquitous embedded systems framework for energy-aware buildings using activity and context knowledge

Editorial

The GreenerBuildings system follows a user centric approach and in that sense the user requirements gathered in the initial phases resulted in the technical requirements to be fulfilled. The result of that work is the proposed system architecture.

The GreenerBuildings system should be operable in large office environments with a big number of rooms, devices, and sensors, and with several processing units working for a common goal. That is why the architecture of the system should ensure the possibility for a proper and easy distribution of tasks among them and foresee a certain level of fault tolerance in case of a partial units failure.

Also the architecture of the GreenerBuildings system should anticipate the ability to scale to a large number of sensors and devices, that is expected in a large office environment. The scalability is important because the system is expected to operate in large office environments with hundreds of sensors, while the fault tolerance is important so that the system in whole stays operational even if some part of the system crashes or fails temporarily.

To be able to scale appropriately, the GreenerBuildings system adopts the notion of cells. A cell is a distinct part of the environment, which can be confined, and distinguished from the other cells. The whole environment of a building is thus split on several cells. The cells configuration does not imply that each cell contains a separate independent system installation. Instead, one component of the system can be responsible for several cells, while another responsible for only one cell, or a smaller set of cells, and vice versa.

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At a Glance

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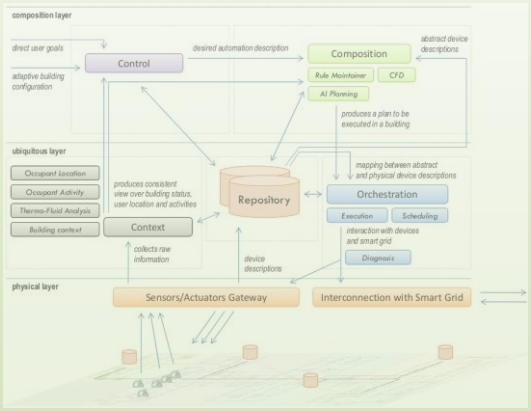
Technical Approach

The GreenerBuildings system is divided into three main layers: physical, ubiquitous, and composition:

- **Physical layer:** The Physical layer is responsible for the hardware part of the system and for the underlying low-level protocols that connect the physical sensors and actuators with the upper layers of the system. To abstract the access to devices, as a part of the Physical layer the Sensors & Actuators Gateway (SAGW) is implemented. While different types of sensors and actuators may require different commands, written in different languages, etc., the SAGW conponent provides the unified control API for higher layers of the system. Another important part of the Physical layer is the Interconnection to Smart Grid component. This component provides ability to the GreenerBuilding system to be aware of external energy pricing and its internal/external availability (for example, from internal wind turbine vs external energy providers), in order to adjust its demand. The awareness about energy supply helps the GreenerBuildings system to adjust its demand so to reduce the energy costs of the building operation, which is a very important ability for any green building.



- **Ubiquitous layer:** The Ubiquitous layer is the middle layer that ensures proper running of the whole GreenerBuildings system, and proper communication with the artificial intelligence built into the system.
- **Composition layer:** The Composition layer is responsible for direct communication with users and facility managers, and for the AI logic incorporated into the GreenerBuildings system behavior. The different subcomponents are responsible for composing atomic actions that need to be performed inside the building, for consistency checking of all rules of building operation and creation and dispatching of necessary actions in order to satisfy those rules after the changes in external situation. One of the valuable additions of this component is the search of the optimal state of the building in terms of energy consumption.

Project Partners

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