GreenerBuildings

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

In an automated system as the GREENERBUILDINGS adaptive system is fundamental to know the context of the building. In fact, only knowing the exact status of the real environments it is possible to take the right decisions, for example bringing the system to a certain desired final state in terms of thermo-climatic, lighting and energy parameters. In order to know precisely the state of the entire building, and its individual spaces together with the activity of the occupants, it is necessary to use a network of distributed sensors. This network of sensors permits to characterize each area and monitor the whole context thus having a correct picture of the latter.

At this point it becomes crucial to identify the optimum positions for the sensors, so that they characterize the specific building without any influence by secondary effects due to the interaction with other devices and to occupant presence.

Many different types of parameters have to be measured in order to characterize the building spaces. Therefore, a broad range of sensor devices are needed, ranging from sensors of temperature, humidity, air velocity and CO_2, occupancy and activity recognition sensors, sensors for lighting, weather stations, to position sensors (windows, doors). The position of the sensors is evaluated in relation to the physical quantity considered, based on the proximity of devices present in the environment and other geometric details of the latter. In GREENERBUILDINGS extensive guidelines have been written for the optimal placement of sensors that derive the thermodynamic state, in order to obtain the best results in the living labs deployments.

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At a Glance

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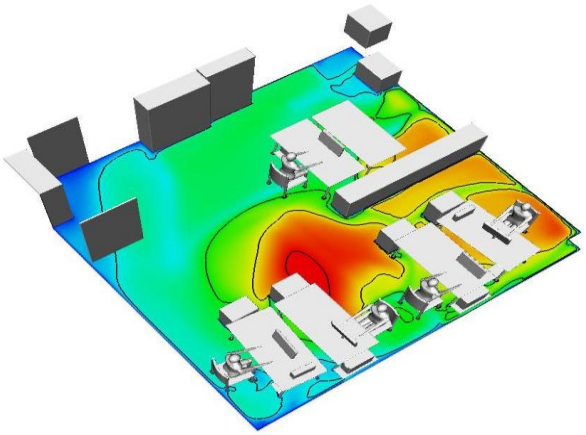
A building is generally a complex system physically described by many parameters both concerning the indoor ambient and the external surroundings. The system building is influenced by chemical, physical and biological parameters and most of them represents factors that influence the occupant comfort and the energy consumption. To elaborate the best guidelines for sensor positioning, it is first of all necessary to provide an overview of the physical ambient considered in the GREENERBUILDINGS project, including the main physical phenomena that evolve in the building and the parameters that describe the indoor spaces. Some of the these parameters are then chosen to be the representative quantity for the building characterization. Included among these preliminary studies are physical phenomena (heat conduction, convection, thermal radiation, occupancy physics) and parameters description (indoor, outdoors, building features). It is also necessary to analyze the different parameter choices, and measurement sensors selected.

Once identified the space to be analyzed and the relevant sensors for the environment monitoring, the procedure consists in the application of thermo fluid dynamics analysis techniques, in this way the positioning of the sensors is carried out with an analytical scientific approach and represents more than a set of empirical rules to be followed. The single phases are: characterizazion of the indoor field using numerical models, measurement campaign using experimental instruments for the acquisition of the physical quantities, analysis of the results and sensors positioning guidelines extraction.



The last step is to provide the actual sensor positioning guidelines. Procedures and indications for different sensors have been formalized mainly related to thermodynamics effects, occupant presence and activity, device type and position. The result is a method to improve physical data acquisition to characterize a typical office spaces, avoiding bad positioning of the sensors, and simplifying the installation setup by the operator.

Project Partners

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