SDU
ENERGY
INFORMATICS

Intelligent Buildings

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What is an intelligent building?

Some definitions

- A building containing a set of integrated services such as heating, lighting, electronic office equipment, etc., controlled by a central computer system which is capable of ensuring the most efficient and sound use of resources (Oxford dictionaries)
- An intelligent building provides a productive and cost-effective environment through optimization of its four basic elements, including: (1) structures, (2) systems, (3) services and management, and (4) the interrelationships between them (The Intelligent Building Institute, US)
- An intelligent building creates an environment that maximizes the effectiveness of its occupants, while at the same time enables the efficient management of resources with minimum life-time costs of hardware and facilities (European Intelligent Building Group, UK)
- Intelligent buildings are designed to be energy-efficient, environmentally friendly, and provide the optimal environment for their occupants (Advanced Control Corp.)
- An intelligent building integrates technology and process to create a facility that is safer, more comfortable and productive for its occupants, and more operationally efficient for its owners (Intelligent Building Dictionary.)
- …

Why do we need intelligent buildings?

Benefits

Health & productivity

Safety & Security

Sustainability & Energy efficiency

Facility operation and management

What is the European perspective?

Building automation and energy performance

- European standard EN15232: "Energy performance of buildings – Impact of Building Automation, Control and Building Management".
- The aim of EN15232 is to support the Directive of Energy Performance of Building (EPBD) to enhance energy performance of buildings in the member states of the EU.
- Standard EN15232 specifies
  - methods to assess the impact of Building Automation and Control System (BACS) and Technical Building Management (TBM) functions on the energy performance of buildings, and
  - a method to define minimum requirements of these functions to be implemented in buildings of different complexities.

	Heating / Cooling control	Ventilation / Air conditioning control	Lighting	Sun protection
A	– Individual room control with communication between controllers – Indoor temperature control of distribution network water temperature – Total interlock between heating and cooling control	– Demand or presence dependent air flow control at room level – Variable set point with load dependant compensation of supply temperature control – Room or exhaust or supply air humidity control	– Automatic daylight control – Automatic occupancy detection manual on / auto off – Automatic occupancy detection manual on / dimmed – Automatic occupancy detection auto on / auto off – Automatic occupancy detection auto on / dimmed	– Combined light/blind/ HVAC control
B	– Individual room control with communication between controllers – Indoor temperature control of distribution network water temperature – Partial interlock between heating and cooling control (dependent on HVAC system)	– Time dependent air flow control at room level – Variable set point with outdoor temperature compensation of supply temperature control – Room or exhaust or supply air humidity control	– Manual daylight control – Automatic occupancy detection manual on / auto off – Automatic occupancy detection manual on / dimmed – Automatic occupancy detection auto on / auto off – Automatic occupancy detection auto on / dimmed	– Motorized operation with automatic blind control
C	– Individual room automatic control by thermostatic valves or electronic controller – Outside temperature compensated control of distribution network water temperature – Partial interlock between heating and cooling control (dependent on HVAC system)	– Time dependent air flow control at room level – Constant set point of supply temperature control – Supply air humidity limitation	– Manual daylight control – Manual on/off switch + additional sweeping extinction signal – Manual on/off switch	– Motorized operation with manual blind control
D	– No automatic control – No control of distribution network water temperature – No interlock between heating and cooling control	– No air flow control at room level – No supply temperature control – No air humidity control	– Manual daylight control – Manual on/off switch + additional sweeping extinction signal – Manual on/off switch	– Manual operation for blinds

How far are we from intelligent buildings?

A categorization of building intelligence levels

Category	Description
Cognitive	Cognitive building control acts according to learned causality between events and observed effects
Proactive	Proactive building control acts in advance to deal with the anticipated effects of expected future events
Active	Active building control acts during the occurrence of an event to deal with anticipated effects of the event
Reactive	Reactive building control acts in response to the observed effects of aperiodic events
Repetitive	Repetitive building control acts in anticipation of periodic events
Inactive	Inactive buildings have no control

What are the barriers for intelligent buildings?

Main barriers

- Building traditions
- Construction costs
- Missing regulatory requirements
- Lack of knowledge
- Lack of skills