Digital progress in building automation

Current development trends and better availability of technology

Does the automation in buildings today match the status of the computer world? Can the latest developments in information technology be applied in buildings? Does it make sense and is it necessary to maintain the "digitization of technical equipment" in residential construction and in functional structures?

Some developers reject digitization on the grounds that building automation, particularly axis-aligned room automation in office buildings, simply causes enormous construction costs, significantly complicates operations and is usually not operator-friendly. And there are some developers who buy themselves a new computer every three years but when it comes to their buildings like to discuss whether a 20 year-old automation station needs to be replaced.

From the perspective of building automation planners, the increasing digitization represents a perfectly normal process in the refinement of technical equipment. Costs are reduced by reproducing applications. The conditions of use and operation in buildings are improving while the operator-friendliness of the equipment is increasing. In addition, modern systems guarantee high availability and safety.

Today's digital technology
Many innovations can be seen in the deployment of digital technology in building automation: network solutions such as cross-trade ethernet, wireless technology, touch panels and app structures are gaining a foothold. This development is driving the use of IP technology – an embedding of building automation functions – in the development of the computer world. Information spanning different trades and the application of many interfaces can be more easily used to exchange information between trades. At the same time, higher demands are now placed on digital IT security.

Fundamental changes
Developments are moving away from conventional controls to security-oriented control systems and database-oriented communication. Software is opening up new possibilities both in the planning process and for operations, e.g. for drawing up complex processes such as fire control matrices (BFSM). We are seeing the first tentative attempts at digital documentation at the transitional stages of the building process – from execution planning, assembly planning and programming via commissioning and as-built documentation all the way to full-blown operation.

But it is not only the relevant trades which are able to prepare and implement this progress more effectively. First and foremost, it is easier to operate the building and use the technology during the usage phase as data can be accessed digitally.

Various areas have emerged in the field of building automation in the last few years that require a separate technical solution. There are different demands made on functional depth, availability and data security. This means that different planning steps have to be taken into account within each trade; see Fig. 1.

Besides the conventional interfaces with the HVAC trades and the electrical engineering, bus interfaces are more and more frequently deployed which increase the quantity and information content of the available functions and facilitate better connections.
Since the beginning of the noughties until the present day, building automation functions have doubled while the costs for building automation data points are falling (tables 1 and 2). There are therefore positive effects in a financial and technical respect from the development of the field

Anzahl der GA-Funktionen (phys. + komm.)

Jahre	2000 - 2005	2005 - 2010	2010 - heute	2020 -
Raumauto-mation je Achse	>= 10	10 - 15	20 - 25	>= 30 *
GA - TGA je Anlage z. B. RLT	20	30	40	>= 55 *

* - Schätzung

Table 1: Growth in the number of building automation functions.

Kosten der GA-Datenpunkte (phys. + komm.)

Jahre	2000 - 2005	2005 - 2010	2010 - heute	2020 -
Raumauto-mation	210,00 €	170,00 €	140,00 €	120,00 € *
GA - TGA	310,00 €	300,00 €	280,00 €	250,00 € *
Sicherheits-gerichtete Steuerungen	-	450,00 €	430,00 €	380,00 € *

* - Schätzung

Table 2: Growth in the cost of building automation data points.

Growth trends

The development of building automation is progressing on several fronts:
- intelligent smart home solutions in residential construction
- digitization in functional structures (technical equipment trades)
- room automation in the axially aligned design of office space

- high voltage and low voltage trades in electrical engineering

All directions contribute to further intensifying the functions of building and room automation as a result of which the field and automation levels fuse and combined field equipment emerges.

In the future, the components of the field level will have to converge more and more as part of the overall development of the business. Because many of the field devices used contain several building automation functions. Combined field sensors/actuators reduce the number of field components themselves as well as the amount of cabling required. Examples include: room control units with room sensors, luminosity and presence sensors, control valves with consumption meters or autonomous fire dampers with smoke detection. The planner should therefore deploy building automation functions sensibly and decide on the basis of the requirements. Sound judgement on the operation of the building and the personnel available for this must be included in the planning process. More information is justifiable in the cost-benefit ratio for energy management and systems analysis during troubleshooting.

Plug-and-play solutions are being installed more and more frequently and, if possible, should be implemented with the cabling for heavy current systems and control units as well as for bus cables. The decentralisation of room automation and with the shifting of functions to the field equipment, e.g. 6-way valves with dew point monitor, temperature sensors and consumption metering, would be the next logical step. This "industrialisation" of building automation reduces installation work and commissioning efforts. The same applies to costs and errors.

New benefits result from the fact that the various disciplines encompassed by communications technology (fire alarm systems, voice alarm systems - video technology, access control - burglar alarms) and the transmission of their functions (states, approvals) are fusing. Even aspects of the lighting, emergency lighting system / emergency exit control and sunscreening contribute towards the digitization of buildings.

The demands made on building automation planning are increasing thanks to digitization:
- higher requirements for redundancy and safety in fire prevention and smoke extraction
- complex IT planning (firewalls / virus protection, access control, data protection, data backups)
- database-driven building automation planning

Current examples show the refinement and extension of digitization solutions in buildings.

Example 1: Pilot project in a functional structure
A pilot project at the special exhibition of the Light + Building trade fair in 2016 demonstrated cross-trade communication in a few important processes (Fig. 3 Scenarios) in a functional building. The exchange of data between building automation and the various fields of communication technology revealed itself to be a particular challenge. This solution is based on a physical building automation network for transmitting various data protocols such as BACnet,

Modbus, KNX and SNMP. The fire loads in the building are minimised as a result (fewer cables), and the system can be easily extended in the usable area.

Example 2: Digital interface solution
The following interface solution (fire alarm system / fire prevention and smoke extraction system) in a new high-rise in Frankfurt am Main will undoubtedly become the state of the art in future and replace conventional solutions with coupling elements (Fig. 4).

Signals from the fire alarm system are transmitted to the safety-based control unit for triggering smoke extraction via redundant gateways by means of a safety-based protocol interface. In the process, smoke extraction systems, smoke barriers, smoke pressure systems in the stairwells, fresh air and extraction vents in the façades and soffit vents of the high-rise, façade windows in the atrium, smoke extraction panels and local control elements are all triggered and the air conditioning system is switched off and fire dampers closed.

Example 3: Database-oriented solution
The planning and implementation of fire prevention and smoke extraction systems proves to be a complex process with today's data volumes. Due to the enormous volume of data that had to be managed in the construction phase and later during the entire period in which the building was operated, a database-oriented solution was preferred in the design planning of the Frankfurt high-rise project to the conventional design of the fire control matrix in the form of Excel tables.

The planners designed a database and recorded all the data required for carrying out tests of the operating principle and authentic sample tests in accordance with VDI 6010-3. The concept comprised all appliances in their entirety in accordance with the specifications and conditions of the fire prevention concept, and the expert reports/opinions submitted by specialists for smoke extraction systems:

- fire detection and alarm systems
- systems for extracting smoke (ventilation systems / smoke extraction and smoke pressure systems)
- natural smoke extraction systems / openings
- fire extinguisher systems / fire barriers (doors and curtains)

The programs for the safety-based control units were prepared on the basis of the database. These control units are especially significant in view of the upcoming requirements to carry out repeated tests of the "safety appliances in buildings, authentic sample tests and tests of the operating principles" in accordance with the identical VDI 6010/3. The database-oriented provision of as-built documentation for smoke extraction makes it significantly easier to conduct tests.

Conclusion
The use of new IT solutions is being adopted anyway in the development offices of the building automation sector. Any qualitative planning will take into account the future requirements of the building when operating and will thereby lead to the optimum solution. In view of the 30 to 50-

year useful life of a building, both the planning time and investment in future-proof technology represent money well spent; see Fig. 6, chart: Effect of planning-usage efficacy with respect to the time axis in the construction process.

In the course of the further digitization of technical equipment, managing commissioning in the construction phase and quality control by means of tests conducted on the operating principles on acceptance and during operations are of crucial importance for the developer.

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Pictures:

Fig. 1:

<table>
<tr><th colspan="3">Bereiche der Gebäudeautomation</th></tr>
<tr><td rowspan="4">Schnittstellen (HLKS, Starkstrom, Schwachstrom)</td><td colspan="2">Managementebene, Betrieb</td></tr>
<tr><td>Raumautomation</td><td rowspan="2">Verbrauchs-erfassung, Energie-management</td></tr>
<tr><td>Technik (Informationsschwerpunkte der HLKS-Gewerke)</td></tr>
<tr><td colspan="2">Brandschutz, Rauchfreihaltung (sicherheitsgerichtete Steuerungen)</td></tr>
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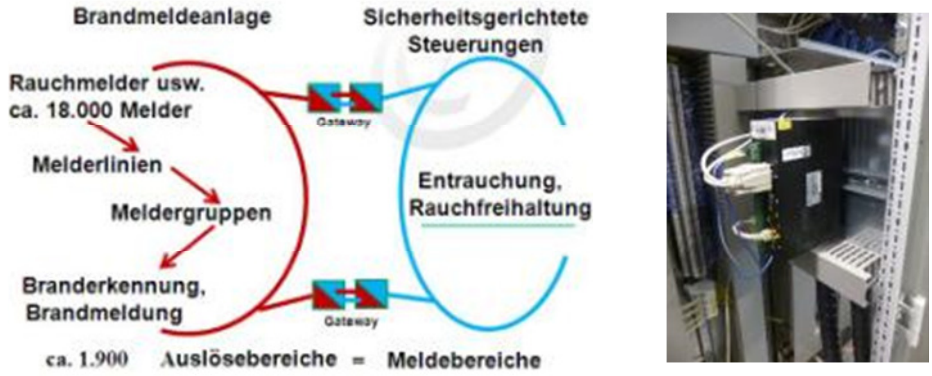
Bereiche der Gebäudeautomation.

Fig. 2

Light + Building Fair 2016, Special Exhibition "Digital Building"
Source: Messe Frankfurt Exhibition GmbH/Jens Liebchen.

Fig. 3 Scenarios of the special exhibition

Fig. 4



Portrayal of the interface overview; fire alarm system / fire prevention and smoke extraction system gateway in the high-rise

Fig. 5

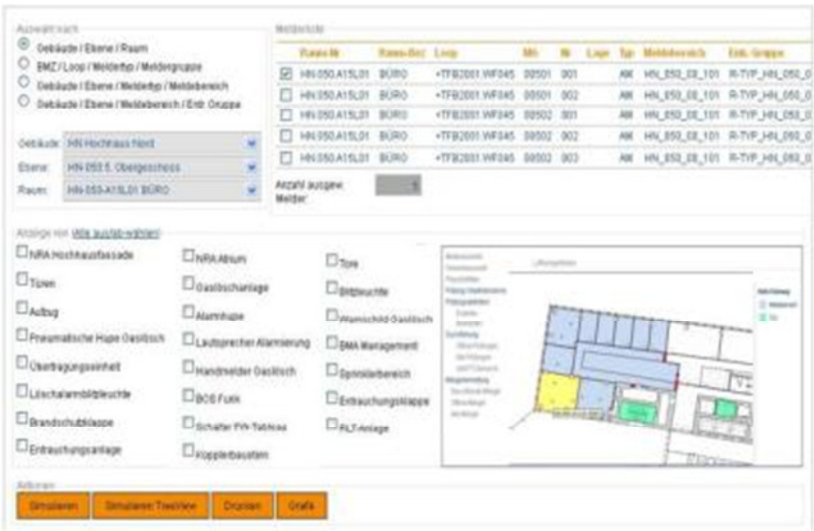


Fig. 5: Selection screen in the database

Fig. 6

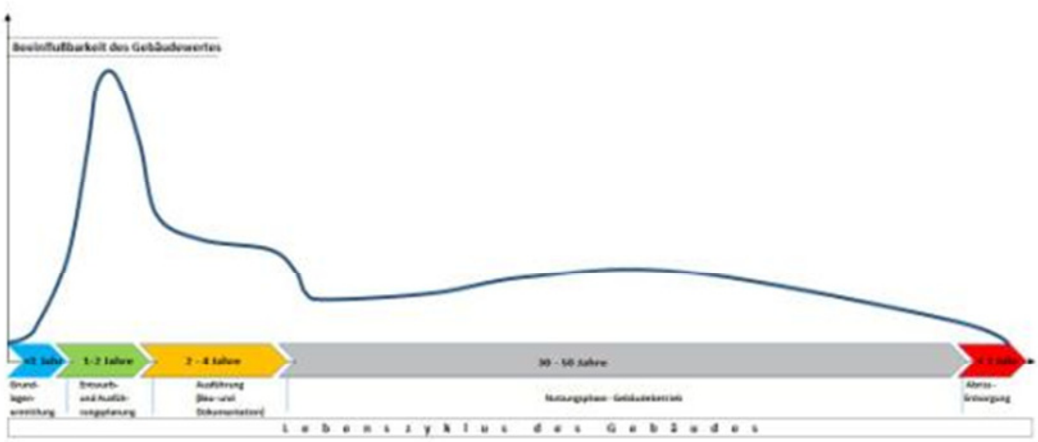


Fig. 6: Efficacy in the construction/utilisation process

Abbreviations:
BFSM - Brandfallsteuermatrix [fire control matrix]
BMA/ABE – Brandmeldeanlagen/Automatisierte Brandschutz- und Entrauchungssysteme [fire alarm system / automated fire prevention and smoke extraction systems]
EMA - Einbruchsmeldeanlagen [burglar alarm systems]
GA - Gebäudeautomation [building automation]
SAA - Sprachalarmierungsanlagen [voice alarm systems]
ZuKo - Zutrittskontrolle [access control]

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http://www.ecsel.de/

About Canzler
Canzler GmbH was founded in the Ruhr District in 1960 as an independent planning office for technical equipment. Since then the company has developed into a general planner and consultant for all phases of the life cycles of properties. The company performs architectural and engineering services across all disciplines as well as offering FM-Consulting and supports clients in the field of property management. At its locations in Berlin, Dresden, Erfurt, Frankfurt am Main, Hamburg, Munich and Mülheim an der Ruhr Canzler employs more than 120 people. Since 2008 Canzler has belonged to the internationally operating Socotec Group, an engineering services provider employing 5,000 people.

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