



Professional paper

Ključne reči: pametne fleksibilne laboratorije; digitalizacija; bezbednost; sigurnost; automatizacija

PAMETNE LABORATORIJE IZ PERSPEKTIVE GRAĐEVINE

Key words: smart flexible laboratories; digitalization; safety; security; automation

SMART LABORATORIES IN BUILDING PERSPECTIVE

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Oblast laboratorijskog razvoja i istraživanja ubrzano napreduje i u skladu sa time podižu se standardi i očekivanja vezana za infrastrukturu.

Oblast istraživanja i razvoja se brzo razvija, a kao rezultat toga, menjaju se standardi i očekivanja vezana za savremenije i efikasne laboratorije. Ključne komponente za uspeh i kurentnost na globalnom nivou su interdisciplinarni timski rad, digitalizacija i prilagodljiva infrastruktura. Ispunjavanje ovih zahteva zahteva napredne koncepte i inovativna rešenja, jer tradicionalni pristupi više neće biti dovoljni.

The landscape of Research & Development is evolving rapidly, and as a result, both the standards and expectations for cutting-edge and effective laboratories are changing too. To stay competitive on a global scale, interdisciplinary teamwork, digitalization, and adaptable infrastructure are now crucial components for success. Meeting these requirements demands forward-thinking concepts and innovative solutions, as traditional approaches will no longer suffice.

A fundamentally new approach is required to address the challenges of future research spaces.

1. Smart Laboratories in building perspective

1.1. Introduction

Research laboratories are facing many challenges:

- Shorter innovation times
- Changing research project structure
- Move from single lab to open space & hybrid environments
- Equipment and facilities shared among users
- Collaboration across disciplines
- Attracting and retaining the best talent
- Energy efficiency and sustainability

The complexity of laboratory infrastructure requires numerous disciplines to be involved, demanding great coordination and execution:

- Lab layout and equipment
- Interior design
- Plumbing and media supply
- Ventilation and air conditioning
- Power supply and electrical installation

- Illumination design and installation
- Safety and security disciplines
- Building automation and management

1.2. What does the lab of the future look like?

People-focused. Traditionally, the research facility has been built to provide the required functionality for a specific type of science or research. While functionality will continue to be important, the future research lab will have a greater focus on user needs, experience, comfort and wellbeing.

Flexible spaces. New highly flexible spaces will focus on technology and tools rather than bespoke designs for a particular branch of science. Collaboration, adaptability of spaces to meet shorter project times and sharing of equipment are coming to the forefront of researchers' requirements.

Digitalization and automation. Powerful new tools will help collect, analyze and share data, and experiments can be monitored remotely for collaboration, regulatory and safety purposes. People and product safety will remain top priority while intelligent, automated tools will make it easier and more cost-effective to achieve.

Remote collaboration. Driven by increasing connectivity, future labs will have a cloud-based component to aid multinational, real-time co-working. Labs could be a cluster of likeminded organizations and spaces rather than a single building and provide researchers with access to equipment and a community outside the institutional framework.

A fundamentally new approach is required to address the challenges of future research spaces.

1.3. Solving tomorrow's challenges with today's technology

A modular, fully integrated smart lab. The lab is fully modular and equipped with the integrated smart technologies needed to provide real-time collaboration and utmost safety and energy efficiency. A complete life-science eco-system of technologies and controls is running seamlessly in the background.

Components of the smart lab are the following.

- Three state-of-the-art fume hoods featuring tailor-made laboratory ventilation
- Specialized modular ceiling components designed to reduce air velocity
- Fully integrated automated controls for HVAC, ventilation, temperature, humidity, fire detection, access control and more
- Lighting based on human biorhythms, indicating dangerous situations
- Video surveillance
- Digital twin for virtual observation and collaboration capabilities

Leveraging the digital twin. As a virtual representation of a product, process, or performance, the digital twin enables the individual process stages to be seamlessly linked. This creates a consistent improvement in efficiency, minimizes failure rates, shortens development cycles, and opens new business opportunities: In other words, it creates a lasting competitive edge.

1.4. The benefits of standardization and integration

Combining standardized agnostic lab components with pre-engineered control systems and modular design results in flexible labs that can easily integrate with building management systems. Integrated automated control systems greatly speed up facility build and verification, as designs, processes and documentation already exist.

- Quick commissioning

- Quicker, easier verification
- Easy to replicate
- Cost-efficient maintenance

1.5. A space to meet your specific life science objectives

Future proof research facilities requirements are (among others):

Enhance collaboration. As scientific work becomes more collaborative, interdisciplinary, and technologically enabled, labs will need to accommodate new ways of working. They will need to include both physical and virtual collaborative spaces and be supported by excellent cloud infrastructure and connectivity.

Optimize energy efficiency. Energy consumption in laboratories is typically five to ten times higher than in office buildings. This is primarily due to ventilation requirements for worker safety and research integrity: two thirds of the energy used in a life science laboratory is associated with meeting air change requirements and comfort control.

Ensure prompt, accurate emergency response. Whatever is being tested or developed in a lab, from explosives to live viruses, safety of people and assets is the highest priority. That's why the control systems in our smart lab are designed to react quickly to health and safety triggers.

Adaptable infrastructure. New highly flexible spaces will focus on technology and tools rather than for a particular branch of science.

2. Reference

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