BEYOND
SMART CITIES

MODULE 17

Controls & Monitoring: Control Hardware

KRISHNAJI PAWAR - CEO & FOUNDER

LEED AP(BD+C),GSAS CGP,GCP,ISO 14001

WWW.BEYONDSMARTCITIES.IN

HIGH-PERFORMANCE BUILDING DESIGN PROFESSIONAL - HBDP EXAM REFRESHER

Controls and monitoring are crucial components in management, engineering, and information systems to ensure processes function effectively and efficiently. Controls are mechanisms or strategies used to guide operations towards achieving desired objectives, while monitoring involves continuous assessment of these operations to ensure compliance with established standards and performance metrics.

Learning Objectives +

- **Energy Analysis: Envelope, Massing, and Orientation Optimization**

- **Energy Analysis: Initial Assessment**

- **Energy Analysis: Ventilation**

- **Energy compliance modeling**

- **Indoor and Site Environment: Thermal Comfort**

- **Indoor and site environments: air quality**

- **Indoor and Site Environment: Lighting**

- **Controls and monitoring: Control Hardware**

- **Controls and Monitoring: Control Strategies**

BEYOND SMART CITIES

CONTROLS AND MONITORING

- Controls guide operations towards achieving objectives.
- Monitoring ensures compliance with standards and performance metrics.
- Controls are categorized into preventive, detective, and corrective controls.
- Preventive controls deter undesirable events.
- Detection controls highlight deviations from expected performance.
- Corrective controls rectify issues to restore systems to their intended state.
- Monitoring evaluates the effectiveness of controls.
- Ongoing and periodic monitoring are used.
- Integration of controls and monitoring creates a robust framework for organizational governance.
- Challenges include resource constraints, resistance to change, and system complexity.
- Understanding controls, monitoring, and their interrelationship promotes efficiency, compliance, and continuous improvement..

CONTROL HARDWARE OVERVIEW

- Control hardware includes sensors, instrumentation, control functions, and centralized monitoring systems.
- Sensors and instrumentation gather data about the operational state of a system.
- Control functions of equipment dictate how systems respond to sensor data.
- Control functions can be classified into Feedback Control, Feedforward Control, and Open-loop Control.
- Central monitoring and control systems aggregate data from various sensors and instruments for a holistic view of system performance.
- Key components include trending, alarms, and remote access.
- Establishing rigorous calibration protocols, defining effective control strategies, and implementing robust monitoring solutions are essential for maintaining optimal system performance.
- As industries evolve towards automation and data-driven decision-making, an in-depth understanding of these components is crucial.

ESTABLISH SENSORS, INSTRUMENTATION, AND CALIBRATION REQUIREMENTS

Understanding Sensors and Instrumentation

- Sensors are devices that detect and respond to physical changes in the environment.
- Instrumentation refers to tools and equipment used to measure and control processes.

Importance of Calibration Requirements

- Calibration is the process of adjusting and verifying the accuracy of a sensor or instrument.
- It ensures that measurements provide correct measurements and prevents serious problems like overheating or misdiagnosing.

STEPS TO ESTABLISH SENSOR AND INSTRUMENTATION REQUIREMENTS +

- Identify the measurement needs: Determine what you need to measure, such as the measurement range, accuracy, and response time.
- Select appropriate sensors: Choose sensors that meet the identified measurement needs, considering environmental conditions, required accuracy, and cost.
- Define calibration requirements: Establish how often the sensors need to be calibrated based on their use and the precision required.
- Develop calibration procedures: Create specific procedures for how calibration will be performed, including reference standards and documentation.
- Establish maintenance protocols: Regular maintenance is essential to keep sensors and instruments in good working condition.
- Train personnel: Ensure all personnel who operate or maintain the sensors and instruments are properly trained.

BEYOND
SMART CITIES

CONTROL AND MONITORING FUNCTIONS OF EQUIPMENT

Control Functions

- Control functions govern the operation of equipment, aiming to maintain desired outputs by manipulating input variables in response to changing conditions.
- Open-loop control is simpler and less expensive but lacks the ability to correct errors or adapt to changing conditions.
- Closed-loop control systems, also known as feedback control systems, continuously monitor output and adjust inputs to achieve desired performance.

Control Strategies

- Proportional Control (P): Adjusts control input proportionally to the error.
- Integral Control (I): Accumulates past errors to eliminate steady-state error.
- Derivative Control (D): Predicts future errors based on the rate of change of the error.

Monitoring Functions

- Real-Time Data Acquisition: Collects data on parameters like temperature, pressure, and vibration.
- Data Logging and Analysis: Crucial for trend analysis and predictive maintenance.
- Alerts and Alarms: Notifies operators of abnormal conditions.

CENTRAL MONITORING AND CONTROL SYSTEMS: REQUIREMENTS AND CONSIDERATIONS

Trending: Logging Intervals and Storage Capacity

- Trending refers to continuous data collection and analysis over time.
- Logging intervals dictate how frequently data points are recorded.
- Shorter intervals provide high-resolution data for unstable processes, while longer intervals are suitable for gradual systems.

Examples include a semiconductor manufacturing facility using a logging interval of one second for critical parameters like humidity and temperature.

Storage Capacity

- Storage capacity refers to the amount of data that can be retained over time without compromising system performance.
- High-frequency logging generates vast amounts of data, necessitating robust storage solutions.
- Many CMC systems utilize a combination of local and cloud-based storage to handle data.

BEYOND
SMART CITIES

CENTRAL MONITORING AND CONTROL SYSTEMS: REQUIREMENTS AND CONSIDERATIONS +


Alarms

- Alarms serve as immediate alerts for operators when predefined thresholds are breached.
- Types of alarms include Warning Alarms and Critical Alarms.
- Effective alarm management minimizes alarm fatigue and leads to system improvements and process optimizations.

Remote Access

- Remote access is vital in modern CMC systems, allowing operators and engineers to monitor and control processes from disparate locations.
- Security considerations include encryption of data and Multi-Factor Authentication (MFA).
- Remote access can be beneficial in industries where operational continuity is paramount, such as the energy sector.

Examples include a water treatment facility monitoring chemical dosing and water quality parameters remotely.
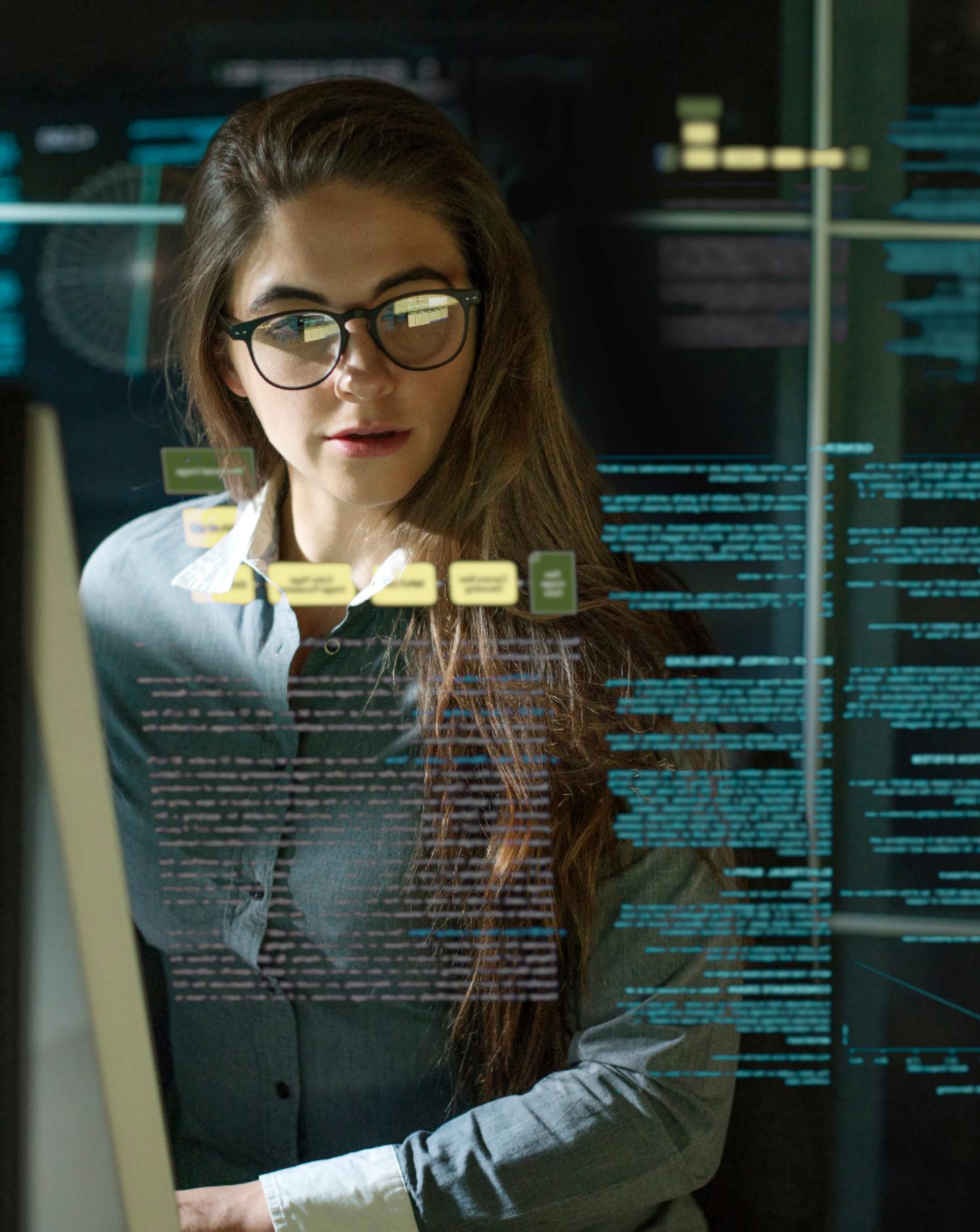
WELCOME TO BEYOND SMART CITIES

The organization promotes scientific and educational interest in sustainability, energy, the environment, and the commissioning industry through its networking and outreach efforts and educational and professional certification programs.

The organization provides a wide range of services, including developing new green building rating programs, green product rating programs, certification services, and green building technology training programs.

Beyond Smart Cities is the first global green technology marketplace, connecting millions of specialists in sustainability, green building, energy, climate change, and manufacturing with independent talent worldwide.

BEYOND
SMART CITIES

CONTACT US

📞 +91 6363032722

✉️ info@beyondsmartcities.in

🌐 learn.beyondsmartcities.in

📍 #55,HMR Layout ,Bengaluru ,India

THANK YOU