



SNS COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 190E219 BUILDING AUTOMATION

IV YEAR /VII SEMESTER

Unit 1- HVAC SYSTEM

Topic : Controllers and Concept of IO's



Introduction



- HVAC (Heating, Ventilation, and Air Conditioning) systems can have various types of controllers **to regulate and maintain indoor climate conditions.**



Types

- **Thermostats:** These are the most basic controllers that allow users to set a desired temperature. They can be manual or programmable.
- **Programmable Thermostats:** These controllers allow users to set temperature schedules for different times of the day and days of the week.
- **Smart Thermostats:** These advanced controllers can learn user preferences, adapt to changing conditions, and can often be controlled remotely through smartphones or other devices.
- **Zone Controllers:** These manage different zones within a building separately, enabling more precise temperature control in different areas.



Types



- **Building Management Systems (BMS):** These are complex controllers that **manage various building systems, including HVAC, lighting, security, and more, all from a centralized interface.**
- **Variable Frequency Drives (VFDs):** These controllers **adjust the speed of motors** (such as those in fans or pumps) to control the flow of air or water, leading to energy savings.
- **Direct Digital Controllers (DDCs):** These digital controllers are used **to monitor and control various HVAC components and can be programmed for complex sequences of operations.**
- **Pressure and Flow Controllers:** These **maintain specific pressure or flow rates in ducts or pipes to ensure proper distribution of air or water.**



Types



- **Humidity Controllers:** These regulate humidity levels by controlling humidifiers or dehumidifiers in the HVAC system.
- **Outdoor Air Controllers:** These manage the introduction of **fresh outdoor air into the building to maintain indoor air quality.**
- **CO2 Controllers:** These monitor and control carbon dioxide levels indoors, helping to maintain a healthy and comfortable environment.
- **Energy Management Systems (EMS):** These controllers focus on optimizing energy usage by coordinating various HVAC components based on energy demand and cost.



Concept of control I/Os

- In HVAC systems, "control I/Os" refer to the Input/Output points used by various controllers **to monitor and control the operation of different components within the system.**
- Control I/Os are the crucial connection points between sensors, controllers, and actuators in HVAC systems
- These points are used to gather information (inputs) from sensors and send commands (outputs) to actuators and devices



Input Points (I/Os): These are sensors that provide information about the system's current conditions.

Examples include:

- **Temperature Sensors:** Measure indoor and outdoor temperatures.
- **Humidity Sensors:** Monitor humidity levels within the space.
- **Pressure Sensors:** Measure air or water pressure in ducts and pipes.
- **CO2 Sensors:** Detect carbon dioxide levels for indoor air quality assessment.
- **Occupancy Sensors:** Determine if a space is occupied or vacant.
- **Smoke and Fire Detectors:** Detect smoke or fire incidents.



Output Points (I/Os): These are actuators and devices that carry out commands to control the system.

Examples include:

- **Valves:** Control the flow of water or refrigerant in heating and cooling systems.
- **Dampers:** Regulate air flow in ducts to different zones.
- **Fans:** Adjust fan speed to control air circulation and ventilation.
- **Heating and Cooling Coils:** Adjust heating or cooling capacity as needed.
- **Humidifiers and Dehumidifiers:** Add or remove moisture from the air.
- **Pumps:** Control water flow through the system's pipes.
- **Compressors:** Control the operation of the refrigeration cycle in cooling systems.



Control Strategies: The control I/Os are utilized by various controllers to implement control strategies.

For instance:

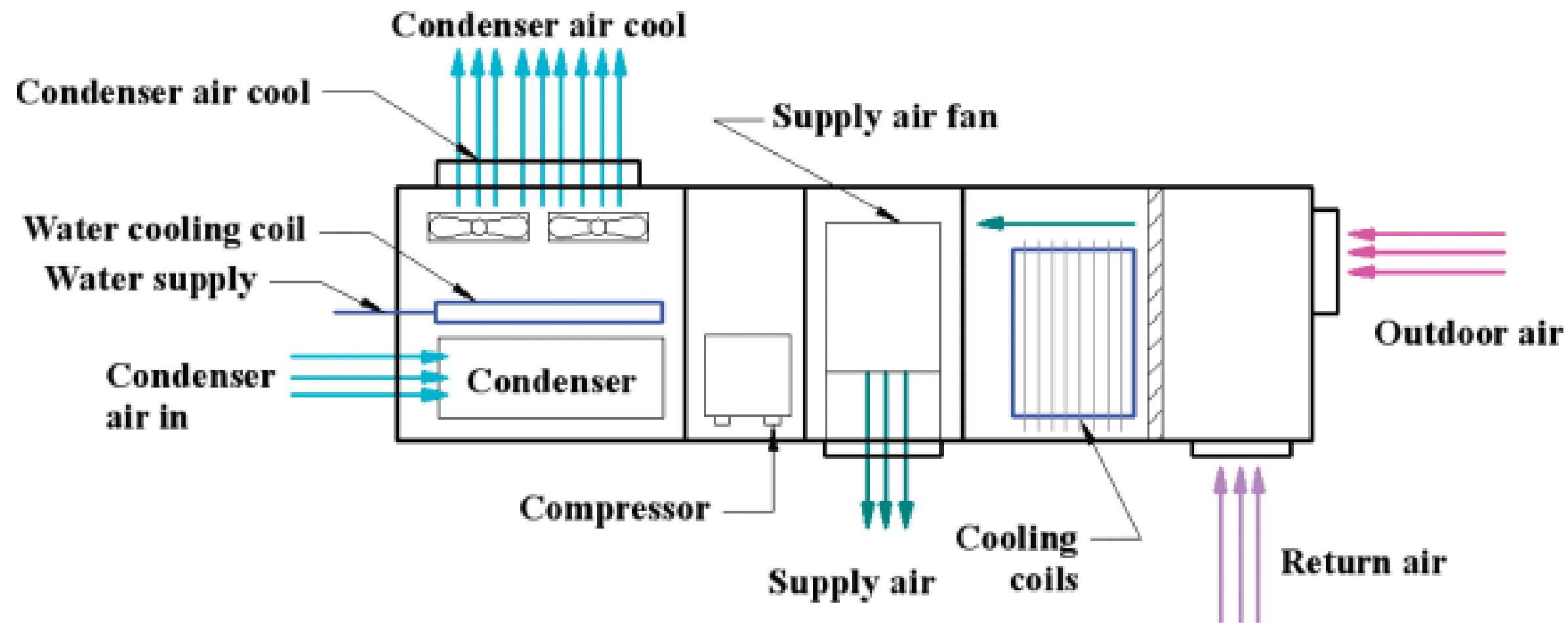
- **Temperature Control:** The system's temperature sensors provide input, and based on the desired temperature setpoint, the controller sends commands to adjust the heating or cooling components.
- **Zoning:** Input from occupancy sensors and temperature sensors helps the controller determine when to open or close dampers to direct airflow to specific zones.
- **Energy Optimization:** Sensors for energy consumption, outdoor conditions, and demand response signals can be used to optimize energy usage by adjusting equipment operation.



Communication:

- Control I/Os often communicate with central control systems, such as Building Management Systems (BMS) or Direct Digital Controllers (DDCs), using protocols like BACnet, Modbus, or LonWorks.
- These systems collect data from sensors and send commands to actuators to maintain desired conditions.

1. Can you say this shown in fig. is the example of which method of HVAC?





References



1. Shengwei Wang, “ Intelligent Buildings and Building Automation”, Routledge 2010.
2. Reinhold A, Carlson Robert A, Di Giandomenico, “Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lightning, Building”, R. S Means company limited, 1st edition, 1991.

Thank You