Training report

On

Building Management System

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INTRODUCTION

The objective of a BMS is to Operation Centralize and Simplify the Monitoring, and Management of a building or buildings. This is done to achieve more efficient building operation at reduced labor and energy costs and provide a safe and more comfortable working environment for building occupants.

What is a Building Management System and how does it work?

The BMS is a "stand alone" computer system that can calculate the pre-set requirements of the building and control the connected plant to meet those needs.
Its inputs, such as temperature sensors and outputs, such as on/off signals are connected into outstations (DDC) around the building.
Programmes within these outstations use this information to decide the necessary level of applied control.
The outstations are linked together (LOOP) and information can be passed from one to another.
In addition a modem is also connected to the system to allow remote
access.

The level of control via the BMS is dependent upon the information received from its sensors

and the way in which its programmes tell it to respond to that information. As well as offering

a precise degree of control to its environment, it can be made to alarm on conditions that

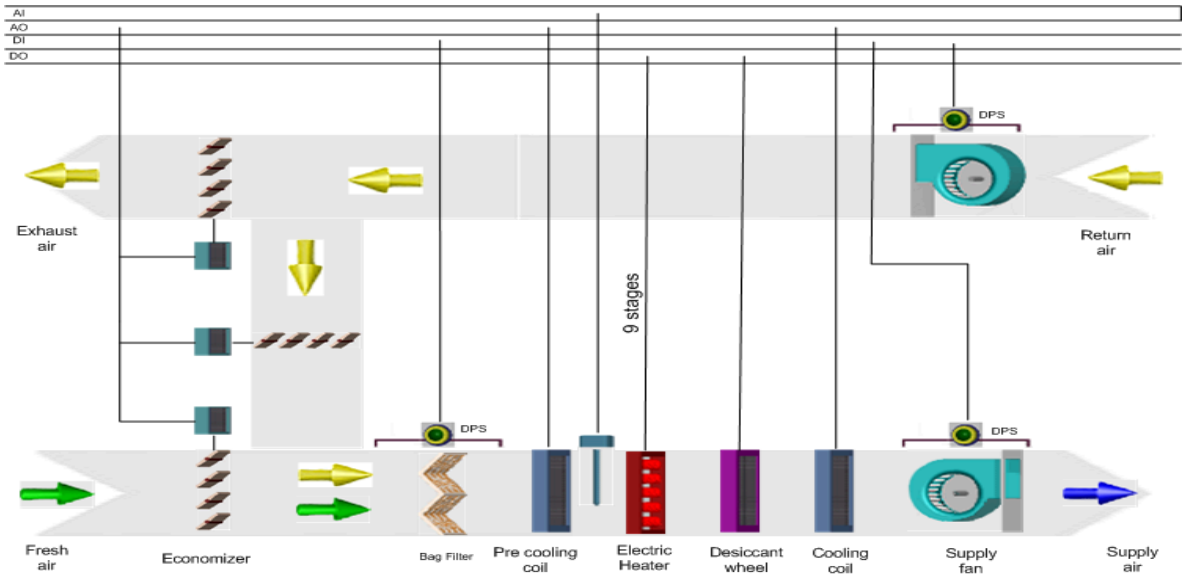
can't meet specification or warn of individual items of plant failure.

Advantages of a BMS are as follows:

1. Simpler operation with routine and repetitive functions .
2. Faster and better responsiveness to occupant needs .
3. Reduced energy cost through centralized management of control and energy management programs.
4. Better management of the facility through historical records, maintenance management programs, and automatic alarm reporting.
5. Flexibility of programming for facility needs, size ,organization, and expansion requirements.

6. Improved operating-cost record keeping for allocating to cost centers and/or charging individual occupants
7. Improved operation through software and hardware integration of multiple sub systems

DEFINITIONS:



BMS Basic Components:

1. Operator Work station (Software)
2. DDC Controllers (direct digital control) :
   - Microprocessor based controls
   - Perform software algorithms and complex sequences
   - Uses A/D and D/A converters
   - Controllers can be stand-alone or networked together
3. Network and network components

4. Measuring devices :

   a. **temperature Sensors**

   - Duct
   - Immersion
   - Wall Plate

- Outside Air
- Averaging

b. **Microset II**

- Wall-mounted intelligent zone sensor and field service tool
- LCD with backlight
- Exchanges data from VLC and VAV controllers
- Displays room setpoint, room temp. and OA temp.
- English or metric units configurable
- Optional humidity sensor
- After hours override

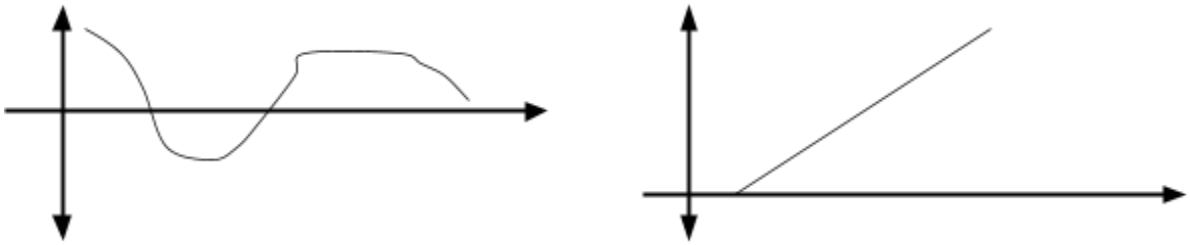
c. Pressure sensors

DPS (differential pressure switch)

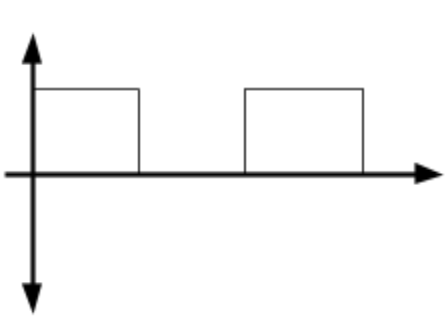
DPT (differential pressure transmitter)

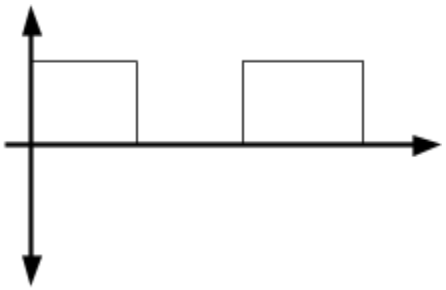
Input and output:

- ***Analog Input*** (AI) : Continuously variable (e.g., Temp. , Pressure, Humidity)
- ***Output Analog*** (AO): Continuously controllable Value (e.g. Modulating valve, Modulating Damper actuator …)



- ***Digital Input*** (DI): Measured Value that has the Value of 0 or 1 (e.g. High level , DPS, Faults„)
- ***Digital Output*** (DO): controlled value (output the has two position ON or OFF

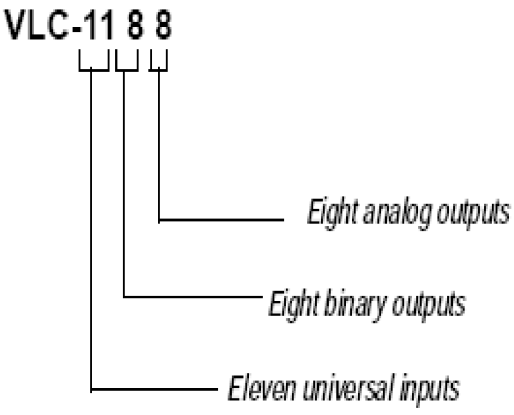




- ***DDC (Direct Digital Control)*** : Microprocessor-based controller**,** A device consisting of a microprocessor unit, digital input and output connections, A/D and D/A converters, a power supply, and software to perform the required functions
- ***Router***: Device that connect two LANs

Typical VLC (visual logic control) Specification :

General Application Controllers



Power Supply:

- 24 VAC with different power rating; check datasheets.
- Always consider max. power rating when sizing TX's
- Half-wave rectified
- Allows single transformer to be used for mulitple VLC's

- GND connection to be earthed.

Auxiliary Power Output:

- 24 VDC for a maximum of 250mA
- Used to power sensors and transducers

Inputs:

- Universal Inputs ; jumper/dips selectable accepts;
- Thermistor 10K and 3K (Type 2)
- Dry contact
- 0-5VDC
- 0-10VDC (only on contollers with jumper settings)
- 4-20mA (requires 250 ohm resistor)
- Pulse Type Inputs (1,2 & 3) ; (1,2 with R) ; none in VAV's
- Only input-0 can be used for BACTalk Microset /Microset II

Outputs:

Binary:

- TRIAC rated at 24VAC , 0.5 Amps
- Common connection to fused 24VAC supply
- VLC with R designation have first 3 as relay outputs
- Relay outputs rated at 120VAC 15A ; 240VAC 10A
- Speed Control (VFD)
- Modulating Dampers
- Modulate a valve
- to regulate flow of water in a pipe
- Regulate 0 to 100%

Analog:

- 8-bit resolution
- 0-10VDC or 4-20mA switch selectable
- Speed Control (VFD)
- Modulating Dampers

Environmental Ratings:

- 0 to158 F / -17 to 70 C
- 0-95% RH ; non condensing
- horizontal or vertical orientation ; also suitable for plenum mounting;

Communications:

- Bacnet over MS/TP up to 76.6 Kbps

BACnet Conformance:

- Approved by BACnet Testing Laboratories (BTL Listed)
- See PICS (Protocol Implementation Conformance Statement for more details)
- Ratings**:**
- UnderWriters Laboritories (both for US and Canada)
- EMC Directive 89/336/EEC (European CE Mark

BMS Common Functions:

1. System Security

- To prevent unauthorized use
- Password protection
- Operator specific access
- Operator log summary

2. Alarm Management

- the presentation in the sequence of importance and time of.. potentially dangerous situations ,process value deviations
- guiding the operator to take appropriate action through.. audible and visual indications, Email, and SMS
- alarm summary Time, date, priority and description

3. Reporting

- present customized subsets of data
- actual or historical state
- export as a word or excel document

- to a printer.

4. Data Logging

- The automatic gathering and storage of data from the field equipment for later analysis and reporting
- Dynamically or historical
- Customized charts and graphs

5. Time Scheduling

- time-based start/stop of the equipment ,saves energy cost and efficient operation,and effective for lighting, occupancy control
- can be as daily, weekly, for holidays or events

6. Remote connectivity

- provide remote access to the system with full functionality through
- local area network
- dial-up
- internet via web browser

BMS Services

1. Mechanical Services

• An open system such as a fully compliant BACNET enables a wide range of compliant sensors controls and equipment which can flexibly plug and play without special programming having to be added or written.

• Automated seasonal temperature adjustment, lowering set point temperature at low
temperatures and gradually raising through the seasons, giving immediate savings.

• Remote alarming to pager, mobile, I-phone, blackberry or fixed line as needed.

• Secure remote access as agreed for fault response, diagnosis, and tenant emergency need. For example, the tenant may need to set up a crisis response unit over a weekend or out of hours. Maintenance contractor may need to drive isolation valves to isolate a water leak, or remotely isolate equipment which has failed to the 'on' position.

• Scheduling calendar to be highly sophisticated so as to be able to check and adjust

for daylight saving, Easter and other events which can be adjusted without programming skills. For example, shutting down unoccupied zones or temporarily varying working hours.

• High turndown capability utilising VSD's for reduced airflow in low occupancy periods. This generally should go to 20 per cent or less of full flow.

• Use of CO2 sensors in car parks and return air ducts to sense when air requirements are reduced. For example, in many car parks it may be sufficient for fans to run for one to two hours per day rather than 12 or 24 hours.

• Occupancy sensors, many areas have minimal occupancy at any time or highly variable loads such as conference rooms. In such cases it may be appropriate to provide minimal conditioned air during normal hours, and ramp up only when space is fully occupied. Ramp up can sometimes be most effectively provided by standalone units to avoid over sizing the central plant to respond to low frequency situation.

• Utilise enthalpy control in low humidity environments. This can improve air quality
and lower energy consumption as air cools when moisture is added.

2. Electrical Services

- Lighting controlled in zones by occupancy sensors, whose area will generally not exceed 100m2 unless special circumstances exist.

- Fire stairs on occupancy sensors with automatic override to full lighting during fire alarm events.

- Car park daylight adaptation lighting to be dual dimmer controlled by photoelectric (PE) cell and occupancy sensors.

- General security lighting to minimum level required by security cameras. With modern cameras this is very low and less than human eye requires.

- Responsive security lighting to be event activated with time controlled manual over ride for emergency situations.

- Metering of equipment and zones to be integrated through BMS to required reports.

- Lift operation to be optimized via intelligent lift controllers, with activity and consumption reports to BMS.

3. *Hydraulic Services*
   - Meters to report to BMS (number must enable excess consumption to system or zone).

   - Temperature optimization control of boilers, by control strategy.

   - Flow meters to alarm on abnormal consumption.

   - Boiler temperature reset optimization, to match actual and predicted loads.

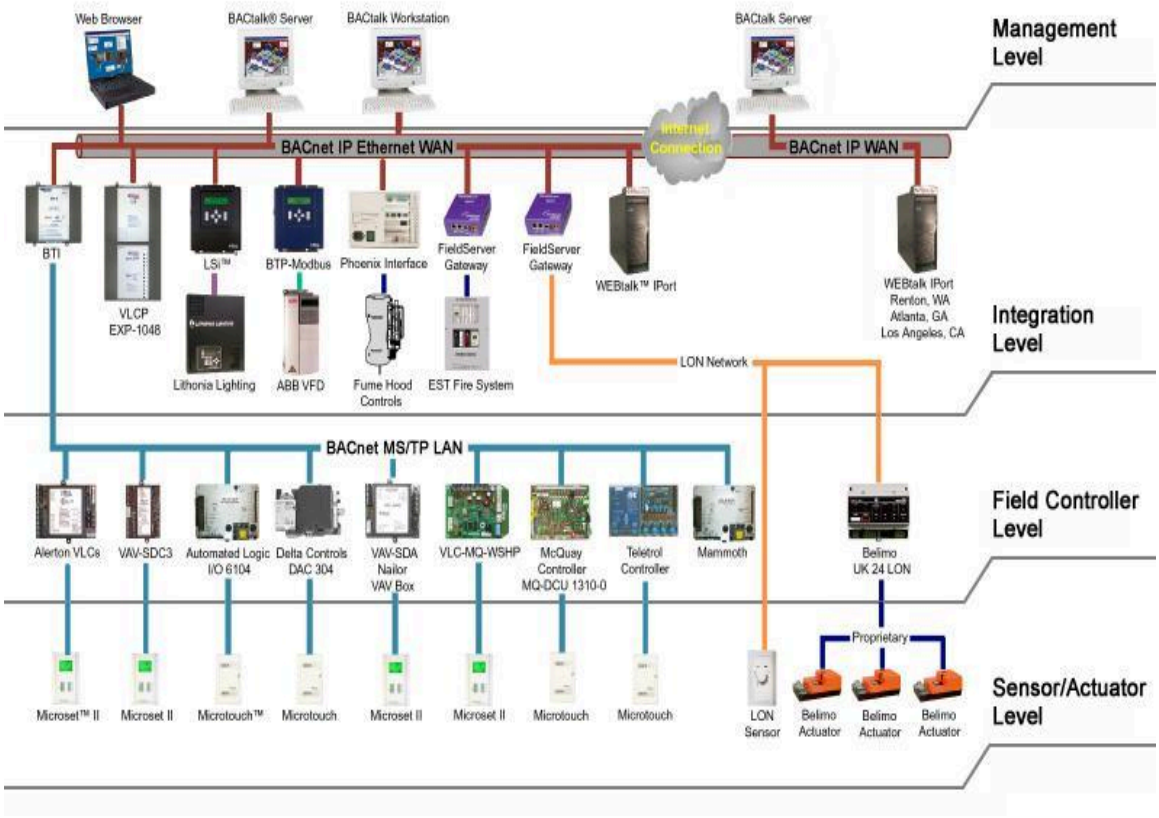
practical part :

We have several field visits for each of the following facilities:

1. The new building of the German University in Madaba
2. The new building of the Embassy of Saudi Arabia in Abdoun
3. The new building criminal evidence department and laboratories in al yasmine
4. the new building of Zarqa Hospital in Zarqa

we have a lot of engineering work in the previous installations like installing direct digital control (panels) which contains a VLCs and then we examined all electronic and make sure the readiness of all the devices such as air handling unit ,fan coil units , supply pumps and all kinds of sensors in the system and then we connect all parts of the system with each other and which in turn connects with the main control (global controller) and which must be connect to the main (PC) in the BMS room .

We have all the engineering and processing, as shown in the drawing



Basic issues we have done by BMS system - flexibility, Safety, Economy, but

- Larger areas to be heated or cooled therefore bigger equipment (e.g. Chillers, pumps, valves)
- Different types heating/cooling equipment are used.
- Operational needs are different e.g. different areas of the buildings occupied at different times ,different areas have differing heating/ cooling requirements and Central monitoring point for Building Energy Management System

what we have to Control and Monitor

1. Room (Air) temperature, humidity, pressure, ventilation
2. Boilers (Hot water services)
3. Chillers (chilled/cold water services)
4. Pumps

5. Fans
6. Lights
7. Flow

For example Point List we have done in al zarqa hospital to AHU NO. 13

	AHU-13 constant air volume Qty=1	DI	DO	AI	AO		
1	Exhaust air smoke detector	1				smoke detector	1
2	Exhaust air temp.			1		duct temp. sensor	1
3	Exhaust pressure sensor			1		Air dpt	1
4	Exhaust Filter dirty status	1				Air dps	1
5	Exhaust Fan air flow status	1				Air dps	1
6	Exhaust Fan start/stop		1				
7	Run around coil fluid return temp			1		immertion temp. sensor	1
8	Run around coil flow status	1				liquid dps	1
9	Run around coil start stop		1				
10	Run around coil fluid supply temp.			1		immertion temp. sensor	1
11	Supply Filter dirty status	1				Air dpt	1
12	cooling valve output				1	2-way modulating valve	1
13	Heating valve output				1	2-way modulating valve	1
14	Cooling Valve position feed back			1			

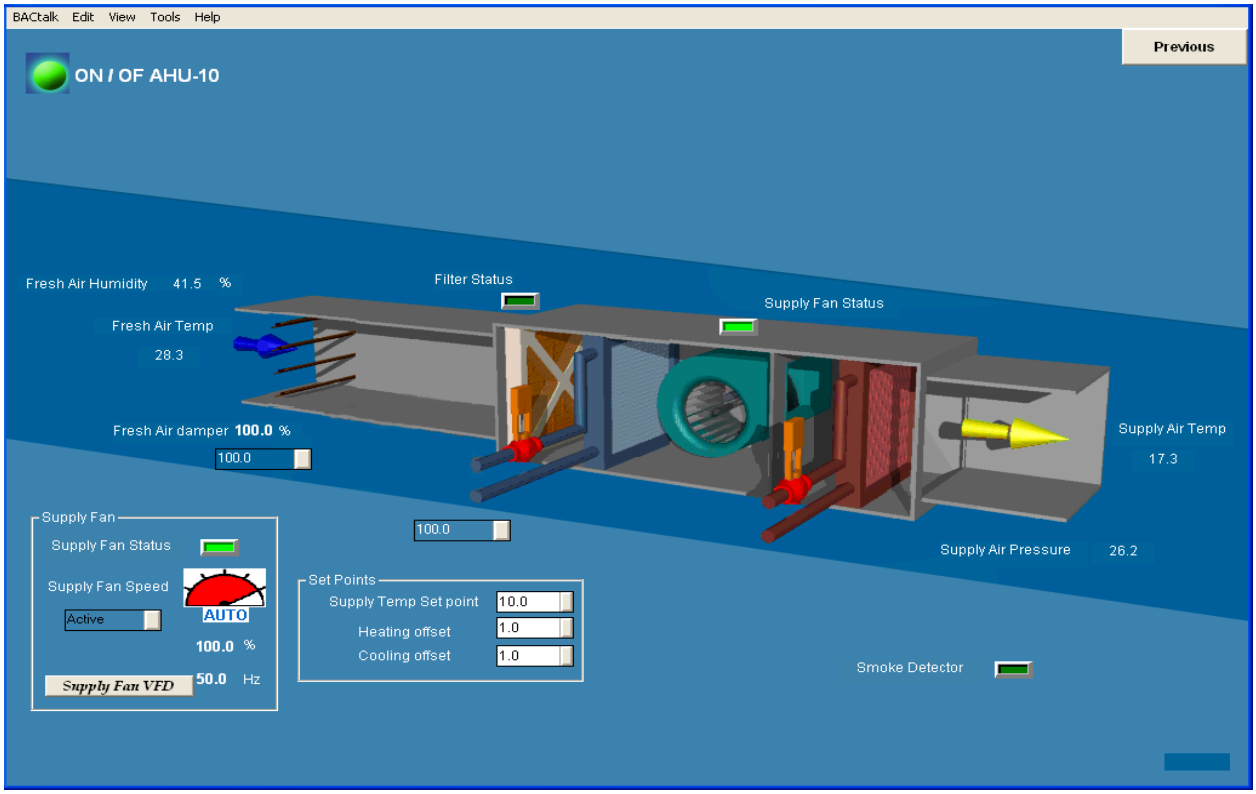
base2 | BASE1 | GRD | 1ST | roof | ADMN BAS1 | ADMN GND | ADMN 1ST | ACC BASE | ACC GND | ACC 1ST | ACC 2ND | ACC 3RD | ACC ROOF

What are Air Handling Units (AHU) ?

Function: Condition the air flow.

- Heat the air flow
- Cool the air flow
- Dehumidify the air flow
- Humidify the air flow
- Clean the air flow
- Distribute the conditioned air into the building space.

Air handling unit



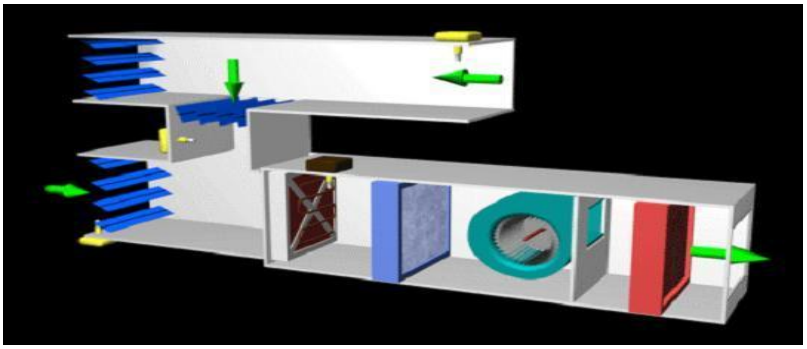
Types of Air Distribution

Constant Volume, Variable Temperature (CV)

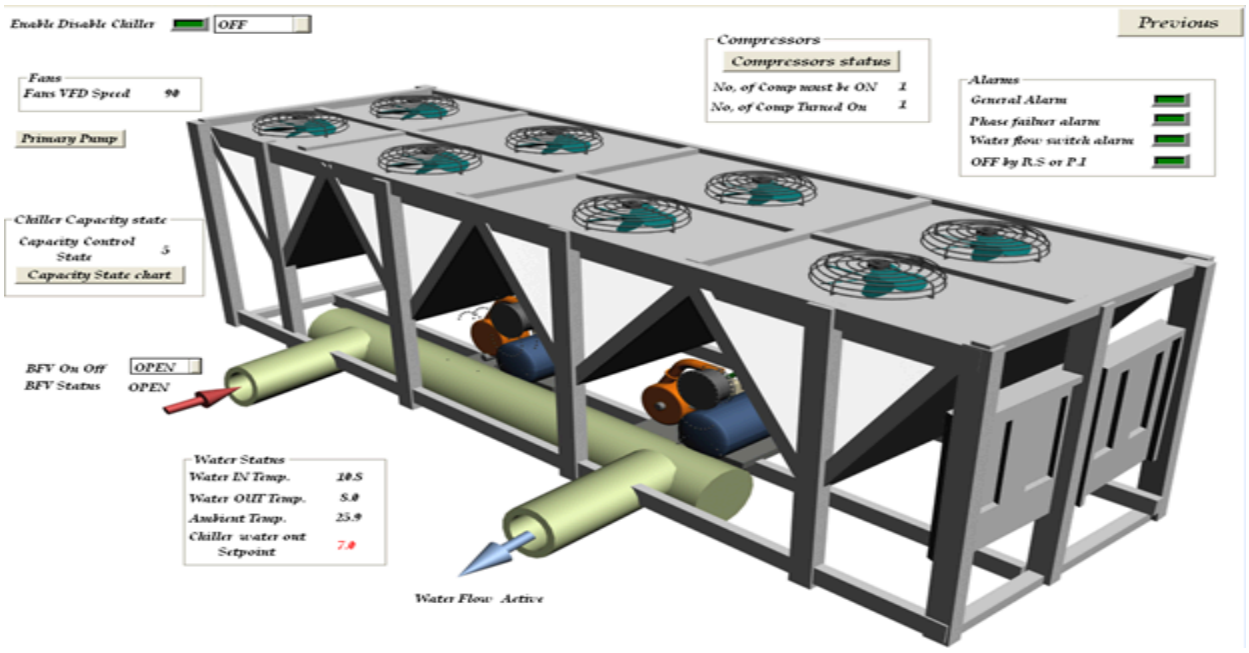
Constant volume of air Delivered to all room areas regardless of individual room differences.

VAV -Variable Air Volume:

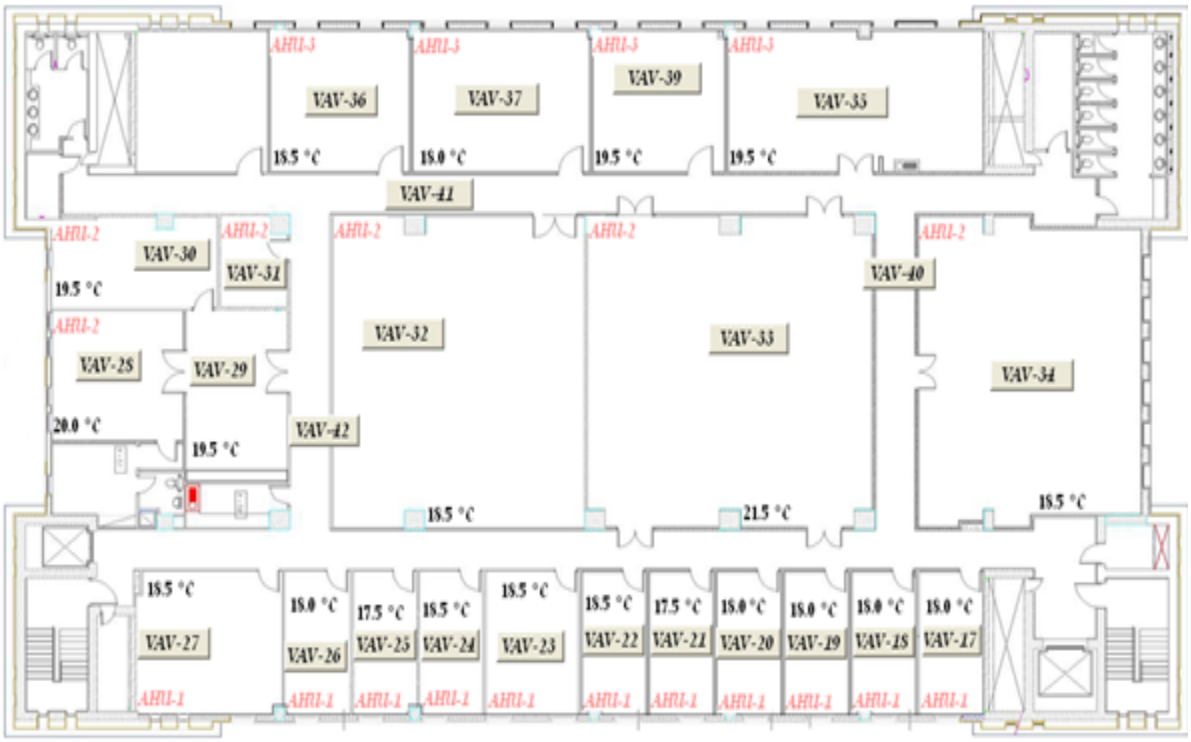
» Variable volume of air is supplied by AHU at a constant temperature , individual zone temperature is controlled by VAV boxes



Chiller unit



1st floor (VAVs) variable air volume



2nd floor FCs (fan coil units)