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Automated Air Handling Unit System Using SCADA With PLC

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Abstract- Air handling unit (AHU) is a device used to condition and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system. The main scope of AHU is to maintain the Temperature and Relative humidity (RH) of the rooms, by the actuation of hot and cold valves. Raising the temperature without changing the amount of moisture in the air reduces the relative humidity. The relative humidity goes down because warmer air can hold more moisture than colder air. Again humidity is set by opening of cold valve controlled by PID. Since temperature and humidity are interlinked parameters humidity is given to higher priority if both are out of controlled.

The blower air velocity should be maintained suitably as required into the Clean Room Area. The Air Flow is maintained to the Control set value by controlling the speed of VFD with the help of PID controller. SACDA screen having designed and programed assists us in supervising, controlling and acquiescing the entire process data.

***Keywords* – Automation, SCADA, PID, PLC,VFD.**

I. INTRODUCTION

Building Automation Systems (BAS) are centralized, interlinked, networks of hardware and software, which monitor and control the environment in commercial, industrial, and institutional facilities. While managing various building systems, the automation system ensures the operational performance of the facility as well as the comfort and safety of building occupants.HVAC here stands for heating, ventilation and air conditioning. Thus, a HVAC control system applies regulation to a heating and/or air conditioning system. Usually a sensing device is used to compare the actual state (e.g., temperature) with a target state. Then the control system draws a conclusion what action has to be taken (e.g., start the blower).

II. OBJECTIVE AND PROBLEM DEFINITION

AHU systems are the part of hvac systems, which provides free hygienic air to rooms. Air is re-circulated as apart of ventilation and also helps in energy saving and management. Aim of the project is automate the air handling process to room ,with the help PLC programing(Siemens PLC 300 software used for simulation) done in ladder logic. AHU screen is developed in scada, monitoring, controlling of processing parameters (temp,humidity,airvelocity,pressure etc..) as per the set point with use of PID control and vfd drives are done in real time is the objective of the project.Along with that safety precautions like motor safety, emergency stop, are also easily monitored in scada. Graphical view of process is observed and recorded.

- Problem definition

Building automation systems through microcontroller and microprocessors are complex and is not compatible so, selection of automation is the problem. Control of temperature and humidity together is difficult because in controlling one parameter it alters other parameter both are interlinked.

III. PROJECT OVERVIEW

An air handler, or air handling unit (often abbreviated to AHU), is a device used to condition and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system. An air handler is usually a large metal box containing a blower, heating or cooling elements filter racks or chambers, sound attenuators, and dampers. Air handlers usually connect to a ductwork ventilation system that distributes the conditioned air through the building and returns it to the AHU. Sometimes AHUs discharge (supply) and admit (return) air directly to and from the space served without ductwork.

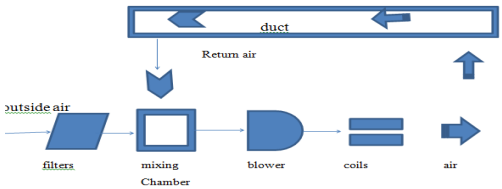

Fig 1: AHU overview

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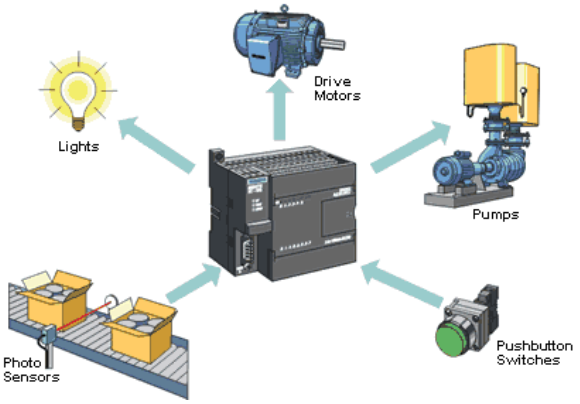
IV. SOFTWARE TOOLS AND SPECIFICATIONS

This project is with the implementation of two software's of Siemens company. Because they are easily understand and write program in blocks and good for simulation work. They are

A. PLC s7-300 simatic manager.
B.SCADA WinCC explorer

A. PLC s7-300 simatic manager

Powerful, compact, cost effective type. The SIMATIC S7-300 universal controller saves on installation space and features a modular design.A wide range of modules can be used to expand the system centrally or to create decentralized structures according to the task at hand, and facilitates a cost-effective stock of spare parts. With its impressive array of innovations, the SIMATIC S7-300 universal controller is an integrated system that will save you additional investment and maintenance costs.PLC consists of an I/O unit, central processing unit, and a memory unit. The input/output unit of the PLC acts as an interface to the real world. Inputs from real work are given to the input unit which is manipulated based on the programming, and the results are given back to the real world through the output unit of the PLC. All logic and control operations, data transfer and data manipulation operations are done by the central processing unit. The results and statuses are stored in the memory of the PLC. PLC's are used for a wide range of applications especially in the field of control and automation. Depending on the number of inputs and outputs required the PLC is selected, here the eight inputs and four outputs along with extension module of same I/O modules is selected.



B. SCADA WinCC explorer

The various output devices used in the system process are induction motor, solenoid valve, cylinders. These are connected to the output module. The induction motor is used to rotate the indexing plate with variable frequency drive to maintain required speed. Five solenoid valves are used for movement of the cylinders which in turn operates the individual work stations. These are the various output devices used in the system. The basic process (as shown in fig I) involved in the system is explained as follows

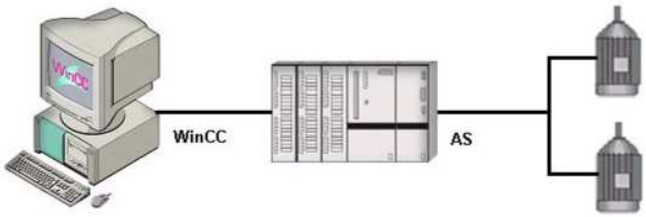


Fig 2:Interface SCADA, PLC and machine

V. SENSORS REQURIED

- Temperature sensor
- Humidity sensors
- Air velocity measuring sensor

VI. SCADA SCREEN DESIGN

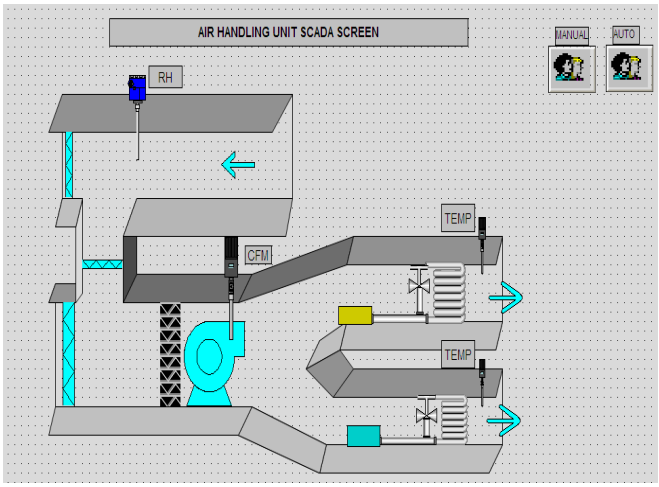
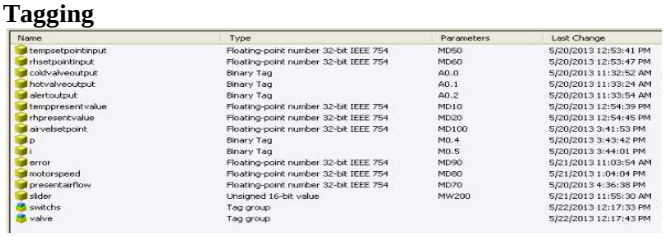


Fig 3: SCADA model screen design

Tagging



Name	Type	Parameters	Last Change
tempsetpointinput	Floating-point number 32-bit IEEE 754	MD50	5/20/2013 12:53:41 PM
rhsetpointinput	Floating-point number 32-bit IEEE 754	MD60	5/20/2013 12:53:47 PM
coldvalveoutput	Binary Tag	A0.0	5/20/2013 11:32:52 AM
hotvalveoutput	Binary Tag	A0.1	5/20/2013 11:33:24 AM
alertoutput	Binary Tag	A0.2	5/20/2013 11:33:54 AM
temppresentvalue	Floating-point number 32-bit IEEE 754	MD10	5/20/2013 12:54:39 PM
rhpresentvalue	Floating-point number 32-bit IEEE 754	MD20	5/20/2013 12:54:45 PM
airvelsetpoint	Floating-point number 32-bit IEEE 754	MD100	5/20/2013 3:41:53 PM
p	Binary Tag	M0.4	5/20/2013 3:43:42 PM
i	Binary Tag	M0.5	5/20/2013 3:44:01 PM
error	Floating-point number 32-bit IEEE 754	MD90	5/21/2013 11:03:54 AM
motorspeed	Floating-point number 32-bit IEEE 754	MD80	5/21/2013 1:04:04 PM
presentairflow	Floating-point number 32-bit IEEE 754	MD70	5/20/2013 4:36:38 PM
slider	Unsigned 16-bit value	MW200	5/21/2013 11:55:30 AM
switchs	Tag group		5/22/2013 12:17:33 PM
valve	Tag group		5/22/2013 12:17:43 PM

Fig4: list of input and output addresses

VII. RESULT ANALYSIS

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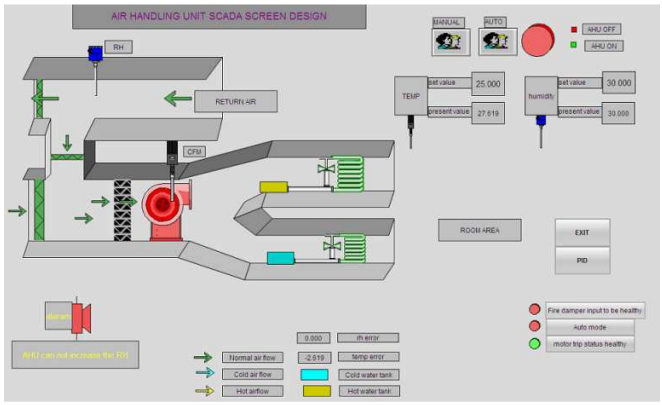

Fig 5: shows AHU is in OFF mode

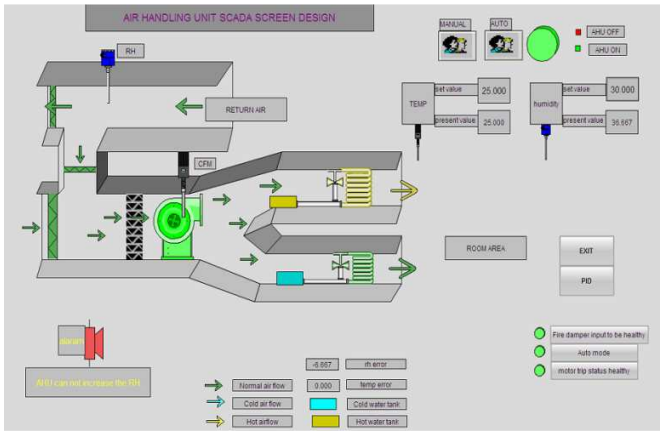

Fig:6: shows actuation of hot water valve.

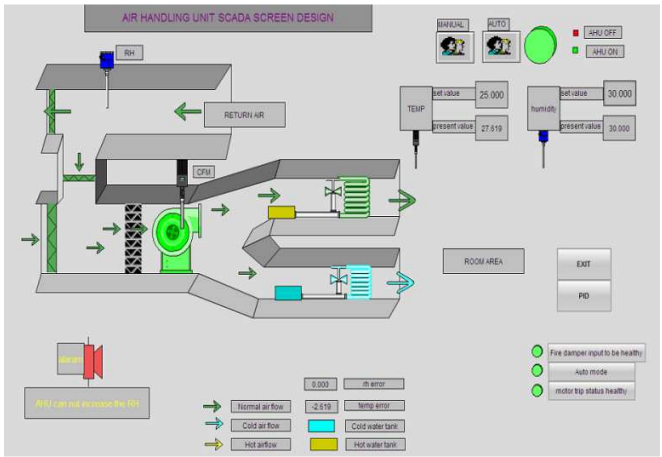

Fig 7: shows actuation of clod valve.

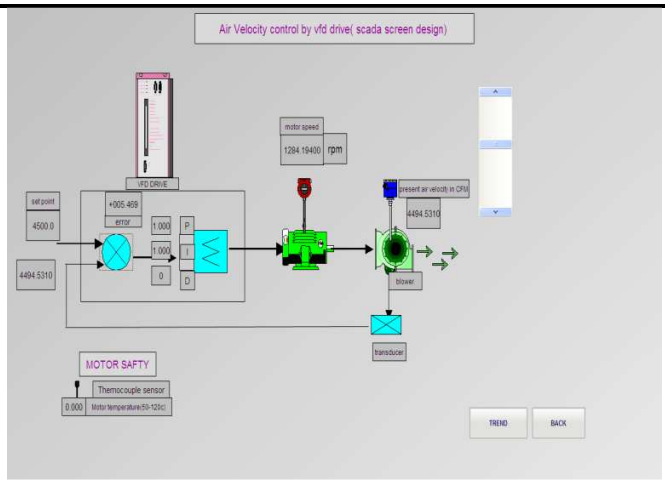

Fig 8: shows air velocity control screen, by VFD drive loop system.

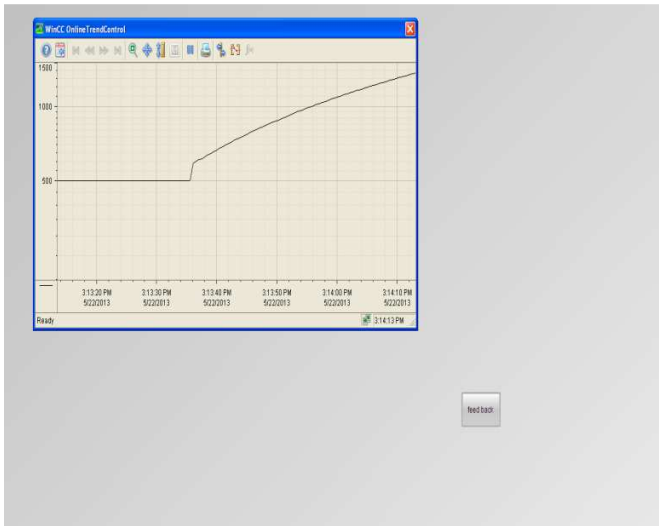

Fig 9: A show tends of motor speed increasing.

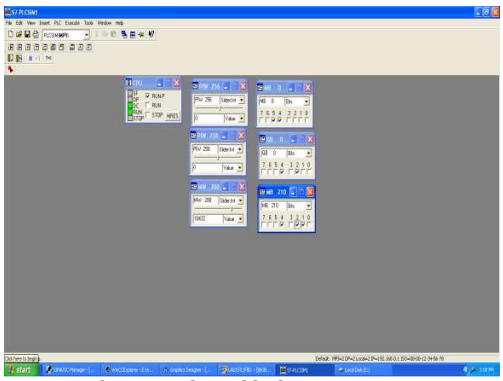
Fig 10: shows simulation blocks to very sensor inputs

VIII. CONCLUSION

From the above project we conclude that, air handling systems with SCADA monitoring are effective. It is easy to control system through SCADA. AHU which controller temperature, humidity and air velocity in to the rooms. That can be effectively utilized in bio-farms. Integration of PID controller in the PLC are accurate maintenance of target value reached. Due to higher priority given to humidity it indirectly controls the temperature. The communication from SCADA to PLC to device is made easy and effective by use of siematic manager and WinCC software tools. That has been already catched up by market.

IX. FUTURE SCOPE

Since the project concentrate only for single room , software tools used for this project, need to use for larger building automation projects. In this simulation project the load capacity of child and hot coils are not considered. Air handling unit objectives are temperature, humidity and air velocity future scope is also provided for factors like air qulity, concentration of oxygen and CO2 ratio in the air and some detection safety factors. Implementation is another second part of the project.

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