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Modifying RPM of Motor with Respect to Temperature using VFD and DCS

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Abstract: ***In large continuous manufacturing plants, it is very difficult for human engineers to monitor and control individual manual or automatic control devices. To overcome this difficulty, Distributed Control System (DCS) is used which is a computerized control system for a process or plant that autonomously coordinates the many subsystems (such as sensors and controllers) located around an industrial facility in real-time. It is very important in controlling complex processes or for large continuous manufacturing plants as it can improve safety, reduce installation costs and enhance reliability and production efficiency. It has numerous predefined functions that come prepared to modify and deploy for different applications. The controlling of RPM (Revolutions per minute) of a three-phase induction motor blower with respect to temperature can be done automatically with the help of Distributed Control System (DCS), Variable Frequency Drive (VFD) and Resistance Temperature Detector (RTD) which can be operated through Supervisory Control and Data Acquisition (SCADA). The DCS has to give set point for VFD to control the motor RPM, this can be automatically achieved by the operator action from the SCADA. A DCS and SCADA combo forms the processing part in this system which firstly detects the temperature via RTD and then compares the data with the set temperature in the SCADA. The set RPM will be relative to the distinction between the set temperature and the current temperature. The VFD varies the RPM of the motor automatically according to the set point value and this process is continued until the set temperature is attained.***

Keywords: Distributed Control System (DCS), Supervisory Control and Data Acquisition (SCADA), Variable Frequency Drive (VFD), Resistance Temperature Detector (RTD), Automation, RPM

I. INTRODUCTION

Everyday various kinds of savvy frameworks are presented with the improvement in innovation. Everything is getting more comprehensible and snappier. There is a development in the interest of bleeding edge innovation and furthermore brilliant electronic frameworks. In the proposed framework, the point is to control the RPM of the motor more easily utilizing the automation technology with respect to temperature using Supervisory Control and Data Acquisition (SCADA) and Distributed Control System (DCS) combo, Variable Frequency Drive (VFD) and Resistance Temperature Detector (RTD).

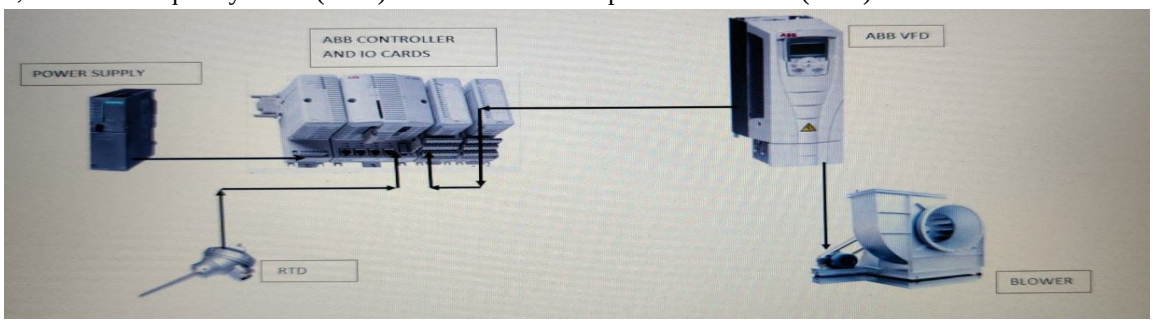

Fig. 1 Schematic diagram

II. MATERIALS AND METHODS

A. *What is DCS*

A distributed control system (DCS) is a computerized control system for a process or plant that autonomously coordinates the many subsystems (such as sensors and controllers) located around an industrial facility in real-time. It has numerous predefined functions that come prepared to modify and deploy for different applications. It can be used in petrochemicals, central station power generation, cement production, steel making, fertilizers, pharmaceuticals, oil refining, food and beverage manufacturing and paper making.

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B. Why is DCS important

Distributed control systems are important in controlling complex processes or for large continuous manufacturing plants as it is very difficult for human engineers to manually monitor many individual systems, which is why a central system is required which is automated. It can improve safety, reduce installation costs and enhance reliability and production efficiency. It enables applications such as preventative maintenance scheduling, production scheduling and information exchange.

C. How DCS will work

DCS is a process-oriented control system which collects data from the field which can be stored, used for process control or in conjunction with data from another part of the plant. It works as a substitute for separate manual and automatic control devices be a unity so that it is easier for maintenance and use. Subsystems such as sensors or data collection devices, communicate with DCS through high-speed communication network after which the DCS analyse and process the collected information and make an automated decision based on the control logic implemented in the controller and send further instructions to individual devices throughout the plant.

D. Components

1) Controller
2) I/O Cards
3) Power Supply Unit (PSU)
4) RTD
5) VFD

III. WORKING

For installing this prototype on an actual field, initially controller will be communicated to a PC which has SCADA and ladder logic operator through which the process is operated and this communication is done through ethernet cable and after they start communicating, I/O cards are assigned and the controller is set as PID controller as all the command will be given or taken in by I/O cards and the PID controller drives the process in the way it is programmed and all this work is done in a software named Control Building M Professional. Now, according to the ladder logic and AI, AO, DI and DO, SCADA is made and its manufacturing is done over a software named ABB Workplace and using this SCADA screen, monitoring as well as process control can be done simultaneously. The DCS has to give set point for VFD to control the motor RPM, this can be automatically achieved by the operator action from the SCADA. DCS will control the drive speed and VFD controls the motor RPM, according to the set point value to save energy and maintain the temperature by pushing appropriate amount of fresh air through a three-phase blower. A DCS and SCADA combo forms the processing part in this system which firstly detects the temperature via RTD (with 4-20mA transmitter) and then compares the data with the set temperature in the SCADA. The set RPM will be relative to the distinction between the set temperature and the current temperature. If the current temperature is greater than the set temperature, the VFD increases the RPM of the motor automatically and if the current temperature is less than the set temperature, the motor RPM will decrease automatically and this process is carried out until the set temperature is attained.

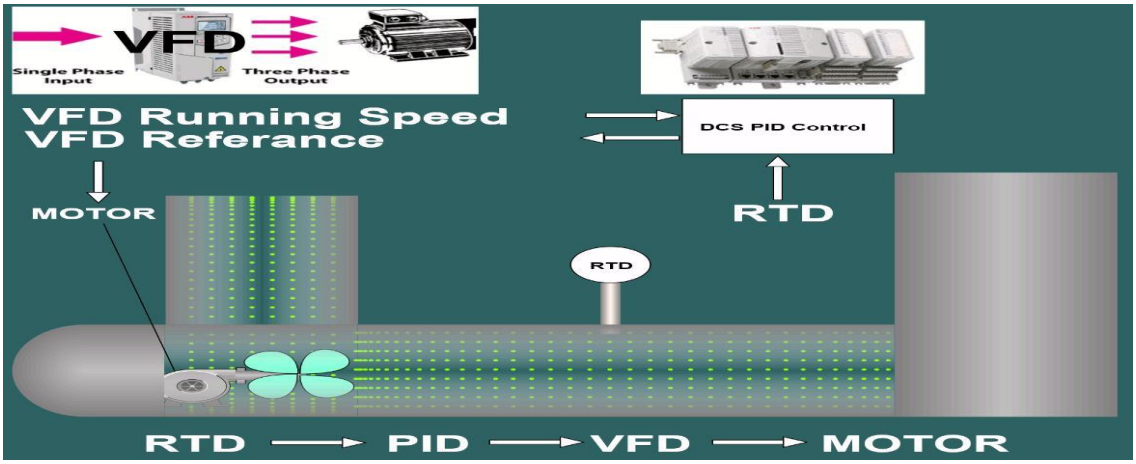

Fig. 2 Working Procedure

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IV. PERFORMANCE EVALUATION

The main focus is on the automation of systems (VFD, RTD, Blower, Motor, etc.) which are installed at the industry field. For a scenario of a mining sight where workers and engineers have to work beneath the earth for several hours continuously and to do so, a work friendly environment has to be maintained where there is ideal temperature as well as fresh air to perform all sorts of activities according to the process. These conditions can be attained by using a three-phase blower which is operated by VFD. Maintaining the temperature of mine is achieved by comparing temperature set point value (which is say 27 degree Celsius) with the actual temperature measured by RTD (which is installed at the site) and using the controller to increase or decrease the RPM of blower motor to make the zero difference. All this process is monitored as well as commanded through SCADA.

V. CONCLUSIONS

Utilizing Automation Technology, RPM of the motor can be varied with respect to the temperature simply by controlling it through VFD and DCS and operating the processes locally or at remote locations through SCADA. In a nut shell, we can say that we can maintain ideal temperature of any place simply by pushing a simple soft button over the SCADA.

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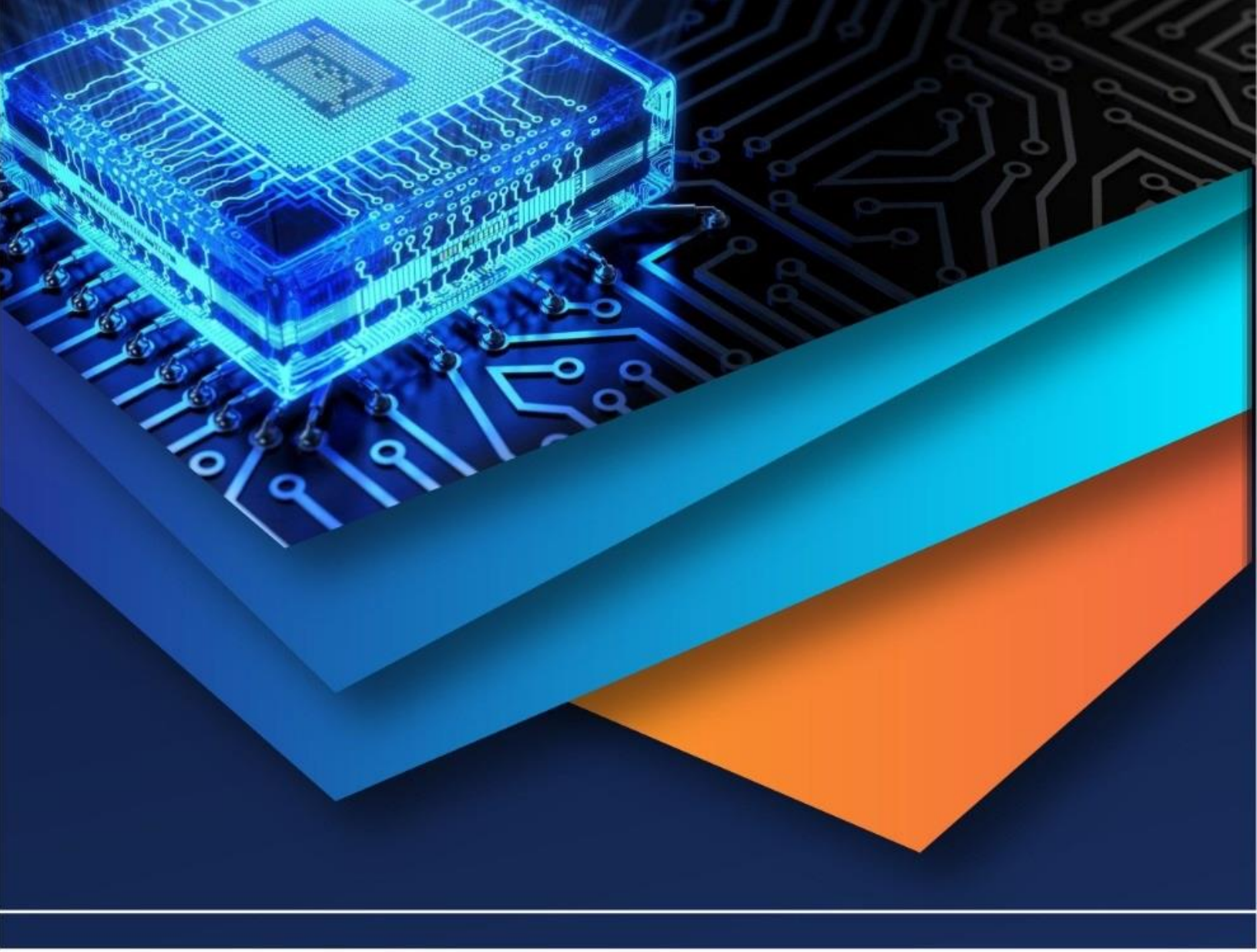

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