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Intelligent Acutator Management System

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Abstract: The project is mainly developed for the industrial plants such as thermal plant, waste water treatment, refineries to get the necessary outcome the flow of liquids where regulated accordingly by the means of control valves in actuator. The flow of stream or liquid is controlled by motor operation like closing or opening the valve by the means of electrical system. All the MOVs are being controlled from UCB (Unit Control Board) as a remote operation. To control and monitor all the operation a bunch of cables have been laid between control valve and control room also it's a time consuming work. To avoid or reduce the down time of the equipments during this situation modification is proposed to meet the above requirement (control and monitoring) an Embedded Based Intelligent Control Module is developed. For each actuator there will be one control module. All the modules can be multi dropped and linked to the main system. Any actuator can be operated or monitored from the control/monitoring mimic. The main system and the other individual slave systems are linked with a single 2 core communication cable using RS485. The total control commands and parameter monitoring will be communicated (as a to and fro) through this cable only. Due to this modification we could save many numbers of cables and reduce the downtime of the equipment during the emergency situation. The necessary virtual control panel will be developed on VB platform.

Keywords: RS 485,intelligent embedded control module, actuator valve; VB.net platform.

I. INTRODUCTION

The main components of a Thermal Power Station are Boiler, Turbine and Generator. The area of control system can be categorized as electrical, Mechanical and Instrumentation. Under electrical scheme most of the drives and systems are driven by electrical supply. Most of the control systems in boiler and turbine are flow of water / steam involved. They are being controlled with variety of valve control methods like Hydraulic based, Air based and electrical based. Our area of concentration is MOV (Motor Operated Valves).

All the MOVs are being controlled from UCB (Unit control board) as a remote operation for ex: To close the flow of chill water a close command will be initiated in the control desk (UCB). The start command will be routed through instruments logics to the .415 volt switch gear module for closing the power contactor (closing circuit).The particular contactor (C1) closed and the power supply will be extended with the phase sequence of R-Y-B .The actuator motor starts to rotate in clockwise and drive the valve spindle through torque multiplier until it reach the end position. The end position limit switch. Detect the end limit and cut out the power supply to the closing coil. Similarly the torque switch will act against excess torque. The same procedures have to be followed for opening the valve. The opening, closing and fault feedback are monitored in the control room via instrument logic panels. For each and every command and to monitor the parameter, a set of cable had been laid between the instrument panel, switchgear module, and field actuator. For ex: for closing operation we have to lay a pair of cable between the instrument panel and switchgear module. Similarly to control and monitor all the operations, a bunch of cables have to be laid between switchgear module, instrument pane and the field actuator. In case of any accident particularly after a fire accident renovation work is very tedious, to replace all this cables we have to put a long effort and also it's a time consuming work. To avoid or reduce the down time of the equipments during this situation we propose a modification.

To meet the above requirement (control and monitoring) an Embedded Based Intelligent Control Module is developed. For each actuator there will be one control module. All the modules can be multi dropped and linked to the main system. Any actuator can be operated or monitored from the control/monitoring mimic. The main system and the other individual slave systems are linked with a single 2 core communication cable using RS485. The total control commands and parameter monitoring will be communicated (as a to and fro) through this cable only. Due to this modification we could save many numbers of cables and reduce the downtime of the equipment during the emergency situation. The necessary virtual control panel will be developed on VB platform.

II. RELATED WORKS

The cooling tower fan system fault monitoring based on the trunk of RS485; Turbine flow meter real-time monitoring system research and design

The monitoring design for the detection fault in blade of the cooling tower was developed in the PC (in remote) [1] [3] the paper described the way of designing and solution for reliable performance.

Application of RS485 for communication and synchronization in distributed electromagnetic exploration system

The use of standard RS 485 communication protocol in industrial plants eliminated the common mode interference and reduced time delay in synchronization and made easy plug and play. [2]

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Reducing the Cost of Tank Farm and Terminal Operations Safety Compliance while Increasing Business Value The above paper mainly developed to overcome the traditional existing methodology followed in industries of UK. The paper focus on safety of the manual operator and to reduce the cost. [4]

III. PROPOSED SYSTEM

The main motive to proposed system is to overcome the traditional process that is being followed where detection fault in actuator valve working, and instant operation of valves are not operated within the time limit. Due to these issues the profit of industries faces a loss in production. The main components of industrial plant for technical process are actuated, and the control valve. The figure1 represent the architecture of the proposed system. In each valve the intelligent control module is attached to collect the status of the control valve. The control module collects the status like limit torque position, valve and other mechanical arrangement. The collected data are transmitted to PC in remote in order to initiate the command for further operation according to the feedback of respective valve status. The data transfer is done with the help of a recommended standard protocol (RS) 485. As a front-end design for a graphical representation of distributed valve is developed using VB.net. The components of the embedded control module in field consist of microcontroller AT89s51, ADC pcf8591 and interposing relay.

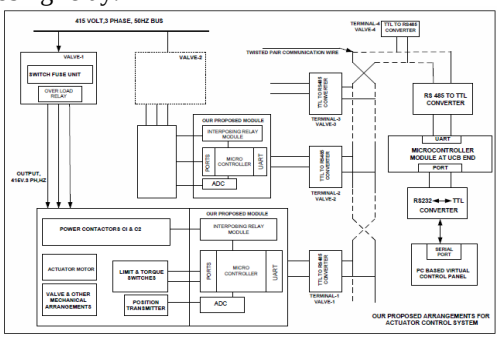


Fig.1 Proposed System.

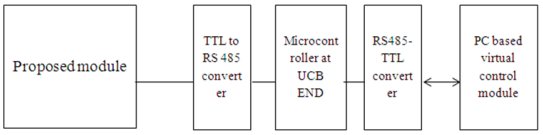
Components of embedded control module:

- PCF8591 (ADC)
- AT89s51 (microcontroller)
- Interposing relay

The analog signal from the valve industries have a common 4-20mA signal that carried into control rooms traditionally. Now using transducer these signals are converted to a voltage which is given as one input to the embedded module. Interposing relay mostly represents the work of switch gear but with 12v power supply for the board. The controller controls the limit torque accordingly to the command that is initiated from the control room (UCB). The industries they have set a certain level of percentage as closing or opening limit. Analyzing such limiting percentage the operator determines the level of flow in actuator valve. Such analysis makes the work and performance easier.

In front panel a graphical representation of distributed valve design is developed as mimics system. The level of voltage, position of the valve flow of liquid in percentage will be displayed.

IV. FLOW OF ARCHITECTURE DESIGN



The MAX485 transceiver for RS485 communication provide half duplex with no slew rate and does not shut down while low voltage and due to the absence of slew rate the EMI is reduced and reflections is eliminated that occur in common cables. T he microcontroller at UCB (Unit Control Board) determines the selection specific valve for their respective feedback.

V. SIMULATION RESULTS

The experiment simulated using Proteus, each real time analysis and data are simulated by designing a circuit. Actuator valve signals are replaced with potentiometer. The position of the potentiometer is considered as positions of actuator and send to the controller via ads and the position is displayed LCD. The status of each actuator motor is collected from their respective valve motor. The microcontroller sends the data from UART which inbuilt to the remote. The analog signal of actuator position is determined by using ADC.

The simulation module determines the position of the actuator valve. The parameters are in current and position.

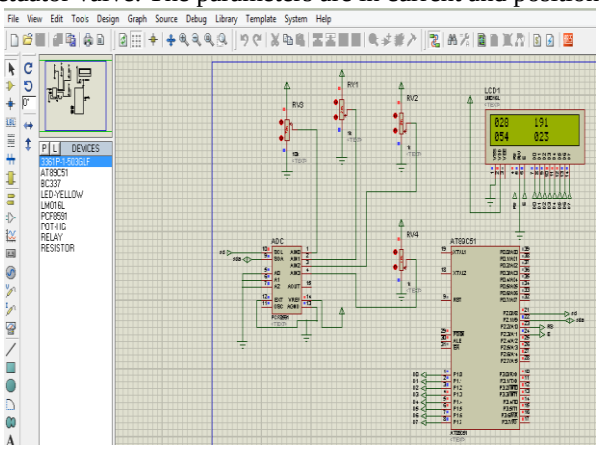


Fig.3 Simulation Of An Actuator Valve Position

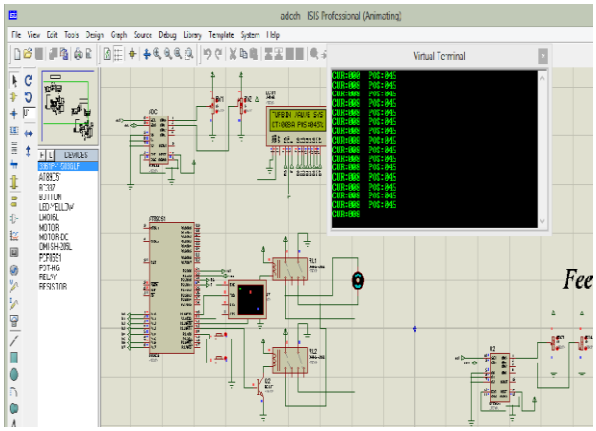


Fig.4. Data transfer via UART

The status of valve is sent to PC wit help of UART. The current and position of status is analyzed.

VI. CONCLUSIONS

This paper deals with the management of actuating control valves in industries that collect the data for analysis and to monitor the condition of the actuator. The paper ensures the data synchronization and provides reliable and efficient performance. The plug and play connection made easier in the cabling between control room and the field. And reduced down time while fire accident by replacing the number of cables. Even wireless technology implemented makes easier.

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