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ARP Burner Automation Using PLC

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***Abstract*— Automatic control is the application of control theory for regulation of processes without direct human intervention. Automatic control can self-regulate a technical plant such as a machine or an industrial process operating condition or parameters by the controllers such as PLC, DCS etc. Automation of burner in ARP is carried out using PLC with SCADA. A limitation of presently used Relay logic system is overcome by the proposed method. In PLC, centralized action takes place.PID can be used in it for controller action. Graphical view of the process can be drawn using SCADA.**

***Index Terms*:-- Automation, PLC, SCADA, Relay logic system, Centralized action, PID**

I. INTRODUCTION

Relay logic [5] is a complicated control system which requires continuous monitoring and inspection at frequent intervals. Relay logic[1] is used for controlling the operation of a burner in Acid regeneration plant. The cost required for the construction of relay logic is lesser. It use relays as the control and logic devices, and using insulated wires. It is not easily damaged by slightly elevated supply voltages, and is not affected by electrical noise and static electricity. There are possibilities of errors at measuring and various stages involved with operators. In this, failure of one contact switch cannot be detected easily ie, Trouble shooting become difficult. Field wire required becomes higher. Here control cannot be distributed. Hence failure of one part affects the whole process. Operation time needed is higher [3]. In order to automate the operation & control of burner automation system and subsiding human intervention, PLC based control system is a good option. The internal storage of instructions of a PLC is used for implementing functions and Thus to control various types of equipment & process variables through digital and or analog input or output modules. One PLC [2] can replace thousands of relays. PLC based control systems are now widely used in the industries like power plants, oil refineries, process plant, and chemical industries etc. It is anticipated that this paper will be effective & helpful to keep pace with the growing needs for PLC based automatic operation & control in the sector of oil & energy.

II. PLC SYSTEM

PLC is a 'digital operating system' designed especially for use in an industrial environment, which uses a programmable memory for its internal operation of user-orientated instructions and for implementing specific function such as logic, sequencing, timing, counting and arithmetic. It is shown in Fig.1.The main difference from other computers is that PLCs[2][3] are armored for severe conditions (such as dust, moisture, heat, cold) and have the facility for extensive input/output (I/O) arrangements. These connect the PLC[] to sensors and actuators. PLCs[2] read limit switches, analog process variables (such as temperature and pressure), and the positions of complex positioning systems. Some use machine vision. On the actuator side, PLCs operate electric motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids or analog outputs. The input/output arrangements may be built into a simple PLC[4], or the PLC[4] may have external I/O modules attached to a computer network that plugs into the PLC.

III. BURNER UTILITIES

A. LPG: It is necessary for giving initial spark for the burner
B. FURNACE OIL-It is the fuel used for the operation of burner. Its pressure and flow is controlled and the temperature is also indicated.
C. STEAM: It is necessary for proper atomizing and to improve the mobility of the furnace oil.
D. COMBUSTION AIR- It is a vital parameter that has fundamental importance for burner operation.

E. INSTRUMENT AIR-It is used for operation of Control valves.

IV. BURNER INTERLOCKS

Process Schematic diagram is shown in Fig. 2

INDIVIDUAL INTERLOCKS

a) Burner temperature < 1400°C
b) Oil pressure > 0.5 kg/m_2
c) Steam pressure > 0 .75kg/m_2
d) Combustion air flow>3000m_3

COMMON INTERLOCKS

a) Oil temperature should lie b/w 90-110°C
b) Roaster pressure should be 150mm to
-150mm H_2O

V. PROCESS OPERATION DESCRIPTION

There are four burners mounted at the bottom portion of roaster. These burners fire tangentially into the roaster and cause a few of hot gases to spiral upwards. These hot gases come into contact with the descending liquor droplets from the spray nozzles. The hot gases evaporate water and free HCL content of the liquor .the spray dried chlorides then reacting to form hydrogen chloride and the appropriate oxides.

$$4FeCl_2 + 4H_2O + O2 \rightarrow 2Fe_2O_3 + 8HC$$

$$2FeCl_3 + 3H_20 \rightarrow Fe_2O_3 + 6HCl$$

Most of the resulting oxide is discharged from the base of the roaster, but some is entrained in the gases leaving out. These gases are passed through a dry cyclone set before flowing outpour-concentrator. The oxide retained by the cyclone set is returned to the oxide slurring box. Successful operation of a process system depends upon careful installation & initial start up. The safe operation & normal shutdown of a system should be done according to the design of that unit. Before start up there should be a thorough check of the system, like valves, control trip, safety device, and all the mechanical and electrical system that should be in good condition. The burners are fired electrically by igniting a LPG pilot flame. When all the conditions for light the burners are satisfied, press the burner start button. When the gas flame is detected by the flame sensor (scanner), the three way valve in the oil line opens and admits oil to the atomizer and this will in turn spray oil in the combustion chamber and then be ignited by the pilot flame. After 30sec, the pilot gas is cut-off automatically. The above operation takes place in 120sec/cycles. In case the burner fails to light; further attempt cannot be made until the burner purge cycle of 120sec is completed.

Burner Starting Procedure

- Checks all the interlocks
- If these are ok press the start button of burner. Purging 10 seconds.
- After 10 seconds open the LPG valve and ignition transformer
- Wait 10seconds for flame sensing
- If flame is sensed oil SOV open and LPG waits for 5seconds
- After 5 seconds LPG turns off.
- If flame is not sensed LPG valve close
- Flowchart for burner operation is shown in Fig 3.

VI SUPERVISORY CONTROL AND DATA ACQUISTION SYSTEM

SCADA [6] is an acronym for Supervisory Control and Data Acquisition. SCADA systems are used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation. These systems encompass the transfer of data between a SCADA central host computer and a number of Remote Terminal Units (RTUs) and/or Programmable Logic Controllers (PLCs), and the central host and the operator terminals. A SCADA system gathers information (such as where a leak on a pipeline has occurred), transfers the information back to a central site, then alerts the home station that a leak has occurred, carrying out necessary analysis and control, such as determining if the leak is critical, and displaying the information in a logical and organized fashion.

SCADA architecture is shown in Fig.4. These systems can be relatively simple, such as one that monitors environmental conditions of a small office building, or very complex, such as a system that monitors all the activity in a nuclear power plant or the activity of a municipal water system. Traditionally, SCADA systems have made use of the Public Switched Network (PSN) for monitoring purposes. Today many systems are monitored using the infrastructure of the corporate Local Area Network (LAN)/Wide Area Network (WAN). Wireless technologies are now being widely deployed for purposes of monitoring. The SCADA can be interfaced to many PLCs and other RTUs . More than one PLC s can be interfaced to the SCADA system.

VII. RESULTS AND DISCUSSION

Interlocks that are used in the proposed system to ensure the system safe operation are tested independently. Interruption of any interlock or process sequence by operation fault or sensor or system fault the respective program sequence for safe operation or shutdown is ensured by the simulation result. In general if any safety interlock is breached the burner is shut off leading by closing the fuel valves and energizing the furnace post purging.

Before opening of the fuel valve all features and interlock for safe start up and operation must be satisfied leading by furnace pre purging system.

Replacement of the conventional system which is consists of many discrete elements like relay, timer, contacts and controller with a single PLC[2], provides more flexibility of the system in case of operation, control, troubleshooting, commissioning and, modification. The presented system would also be beneficiary in economical aspect. Considering the limitation of required version of the software a simplified form of the precise control strategy of the air/fuel ratio controller is described.

VIII. CONCLUSIONS

In this paper we presented about burner automation using PLC. This method is called proposed method. Many disadvantages of existing method are overcome using proposed method as mentioned above. To cope with the technological advancement and to ensure higher efficiency, effectiveness and reliability in a more economical way, the system presented in this paper would be a great scope. It will also provide better flexibility in customization of operation and control with minimum effort. The paper has furnished itself to study the integral parts of the entire processed, their implementation and the problems that can occur have also been investigated with due importance. In future burner automation can be implemented through DCS (Distributed Control system) and a comparison approach can be done. Hence the best method can be chosen for burner automation.

ACKNOWLEDGEMENT

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REFERENCES

[1] BOILER AUTOMATION USING PLC P. K. Bhowmik, and S. K. Dhar *2012* 7th International Conference on Electrical and Computer Engineering 20-22 December, 2012, Dhaka, Bangladesh

[2] “Programmable Controllers: Operation and Application, “Prentice-Hall, Englewood Cliffs, NJ, 1988.

[3] P. K. S. Khan, A. A. Noman and R. K. Dey, “PLC Based Operation of Three Natural Gas Generator Models- A Leering Aid for Undergraduate Students” Third International Conference on Power Systems, Kharagpur, INDIA December 27-29, 2009.

[4] MicroLogix 1762-IF2OF2 Analog Input/Output Module Wikipedia.

[5] Relay logic Wikipedia, the free encyclopedia

[6]SCADA clark science center

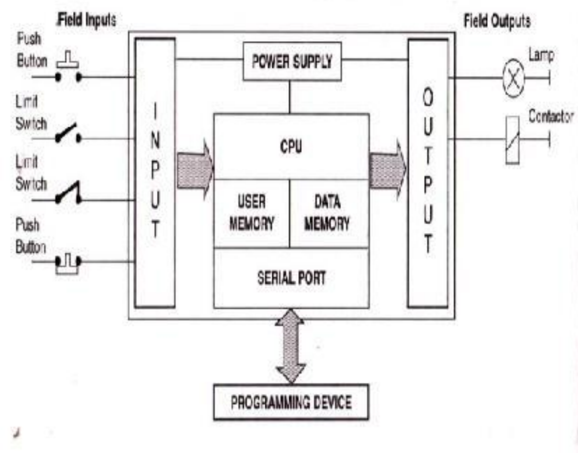

Fig 1. PLC Architecture (IEEE 2012)

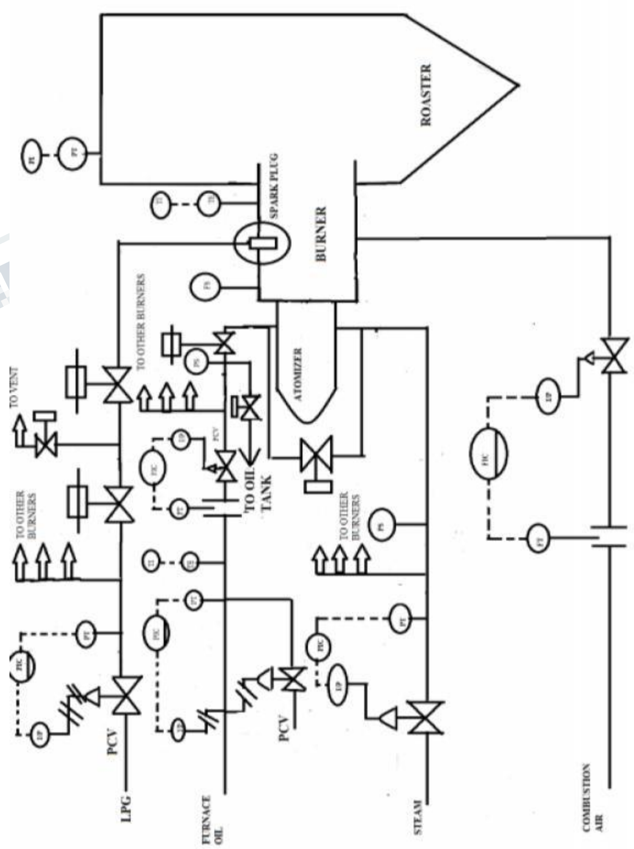

Fig 2: BURNER P&ID

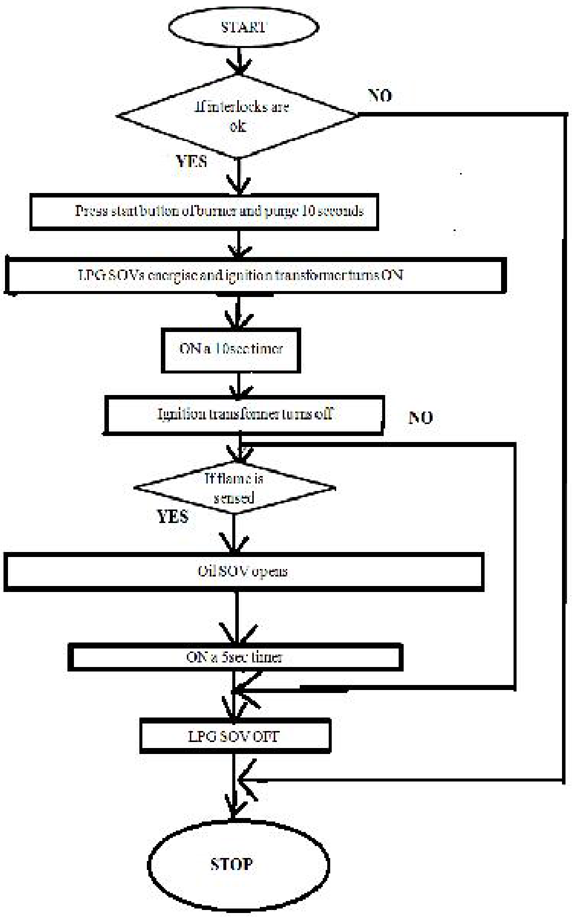

Fig 3 FLOW CHART

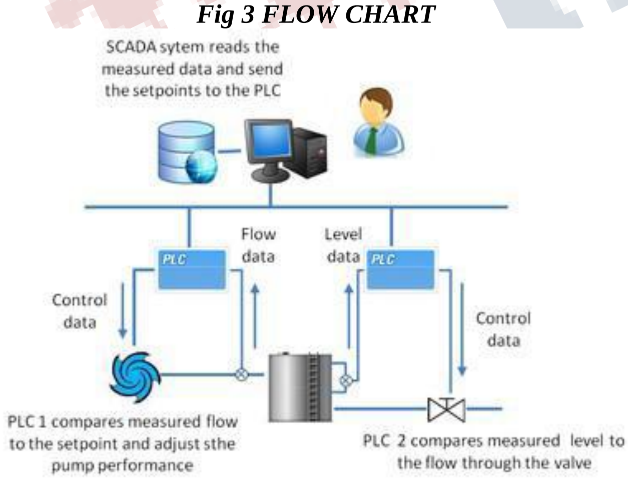

Fig 4: SCADA ARCHITECTURE (IEEE 2012)