GSM Based PLC-SCADA Burner Control System

Snehal Maskare[1] Susmita Pendse[2] Pragati Kamble[3] Prof. V. S.Kamble[4]
[4]Professor
[1,2,3,4]Department of Electrical Engineering
[1,2,3,4]AISSMS's IOIT, Pune, India.

Abstract— The project involves remote monitoring of burner processes. The main objective is to keep in check various parameters involved in the heating processes. The PLC used in the project is GE Fanuc. SCADA system has been implemented so as to suit the operator with graphics of the processes being carried out. The project being GSM based, its motto is to keep the operator (if not present at the site or otherwise) aware of ongoing processes, faults occurring, the air-fuel ratio values etc. The innovation, which is to be developed, is to bring about a two way communication that is, to control the ongoing process, correct the fault via the cell phone or GSM device.

Key words: Programmable logic controller (PLC), Supervisory control and data acquisition (SCADA), Global system for mobile communication (GSM), Input-Output (I/O), Solenoid output valve (SOV), Push button (PB)

I. INTRODUCTION

With the increasing need of improved quality of products and efficient manufacturing, the focus is now on the automation of the Indian manufacturing lines. The automation of machines invariably involves Programmable Logic Controllers (PLC). PLC is a control and monitoring device, which controls the operations of a machine, process or a production line. PLCs find application in standalone machines as well as in complex interlinked process lines.

A Programmable Logic Controller (PLC) is an industrial computer that accepts inputs from switches and sensors, evaluates these in accordance with a stored program, and generates outputs to control machines and processes.

The programming device is a PC that enables the user to create, edit, monitor, upload and download ladder logic (program) to the PLC. The software to program the Versa Max Micro and Nano is called Proficy. Global System for Mobile communication (GSM) has been one of the best trustable wireless communication systems that can be accessed and used very easily.

It is cost effective either if we consider the price of its transceiver module (a simple cellular phone) or the subscription fees. With the trend of huge growing usage of GSM during the past decade, network services is extended beyond speech communication to so many other custom specified applications, machine automation and machine-to-machine communication. SCADA software is used Ellipse.

II. RELATED WORK

In the literature survey, there are few contributions proposed in recent years in machine-to-machine, mobile-to-device, or device–to-mobile communication. These include: designing prototype integrated mobile telemedicine system interfaced with sensors to a patient's body using GSM simulation; designing mobile system with wireless LAN; implementing measurement system to monitor the ambient air quality using GPS, GPRS modem; designing remote control of sensors and actuators using GSM module ; and designing stand-alone human temperature and blood pressure system using microcontroller with embedded software. In line with these works, we describe in this paper the description of a building up a GSM based burner control system using PLC and SCADA

III. BLOCK DIAGRAM

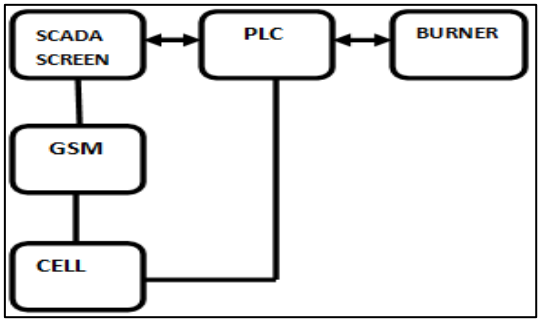

Fig. 1: GSM simulation

The block diagram consists of 5 blocks:

1) BURNER: It has two-way communications with the PLC updating it with the ongoing process.
2) PLC: It has bidirectional interfacing with the scada screen showing visual update of the logic.
3) SCADA SCREEN :It gives us a visual description of process and status of inputs and outputs in form of animation
4) GSM: With the help of an Android phone application, we can acknowledge the process even in absence of an attendee.
5) CELL PHONE: An Android phone is an indirect alarm, which is in the form of a text message received by the supervisor when not present at the site to acknowledge the fault.

IV. PLC SPECIFICATIONS

A. GE – FANUC 14 PNT MICRO PLC:

Weight	**380 grams**
Module Dimensions	Height: 90 mm (3.6 inches) Depth: 76 mm (3.0 inches) Width: 95 mm (3.8 inches)
Typical scan rate	1.0 ms/K of logic
Real time clock accuracy	+/- 0.5 %
Inputs	Eight 24 VDC positive/negative logic input circuits.
Outputs	Six normally open 2 A relay circuits.
High speed counters	Up to four Type A or one Type A and one Type B
Output Power supplies	24 VDC for input circuits and user devices, 200 mA max.

	+5 VDC on pin 7 of serial port 100 mA max.

Table 1: PLC Specification

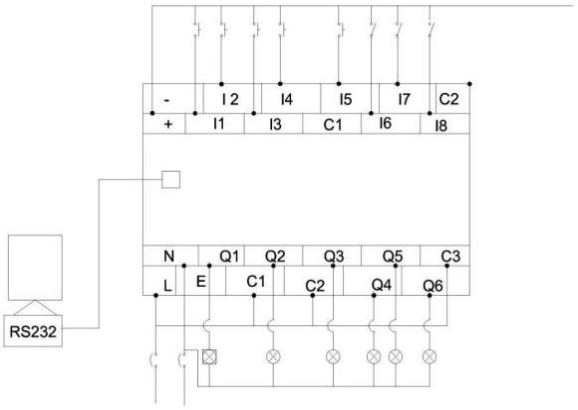

Fig. 2: PLC Specification

V. PANEL SPECIFICATIONS

A. *Inputs:*

1) Burner start pb: to start the furnace.
2) Burner stop pb: to stop the furnace.
3) Acknowledgement pb: to acknowledge the fault and stabilize the alarm.
4) Reset pb: to restart the entire burner system.
5) Pilot flame sensor: to sense the establishment of pilot flame.
6) Main flame sensor: to sense the establishment of main flame.

B. *Outputs:*

1) Hooter
2) Pilot SOV
3) Ignition Transformer
4) Air SOV
5) Oil SOV
6) Alarm

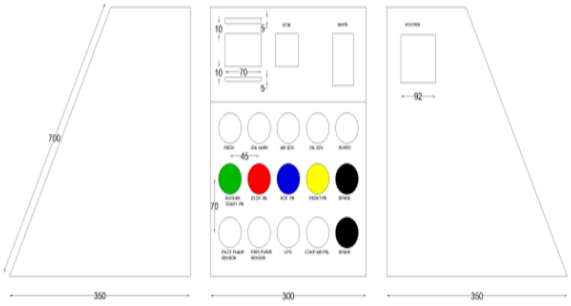

Fig. 3: Panel SPECIFICATIONS

VI. SCADA

Scads software used is 'Elipse'. It is visual based software. Elipse has all the SCADA functionalities for large generation and transmission utilities, such as alarm handling system, fully redundant client-server architecture, distributed processing, historical recording of all monitored variables, report generation, support for main communication protocols, etc. It also has a set of electrical applications that helps operators to maintain a safe and efficient operation. Elipse SCADA provides solutions for connecting with other applications through any physical medium, be it via intranet (via TCP/IP or IPX/SPX protocols), Internet (Elipse WEB), dial-up or private lines, satellites, radio links, or serial .The method being used is based on the concept of Remote Applications, where data from any given application (Server) is accessed by a client that can write and/or read any parameter. Various symbols like pipes, tanks, valves etc. are used which are created as bitmaps. Different process parameters can be recorded in scada. Graph of process parameters versus time can be plotted in Scada for analysis. Scada communicated with the devices on network and collects values from devices into tags. Tags can be used in different formats like color animation, visibility

VII. GSM

GSM (Global System for Mobile communication) is a digital mobile telephony system. GSM provides a high degree of security by using subscriber identity module (SIM) cards and an advanced encryption scheme. This SIM card allows a user to switch from one GSM phone to another. In addition, it offers a bi-directional short message service (SMS) for up to 160 bytes. GSM is available in three frequencies: 900 (MHz), 1800 MHz and 1900 MHz It allows the transmission of basic data services such as SMS (Short Message Service).

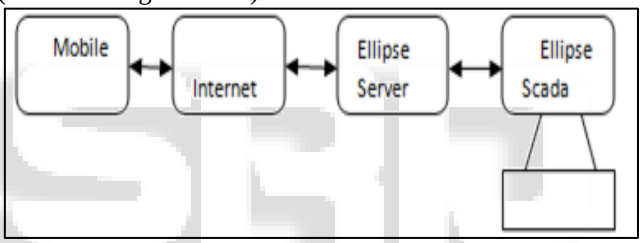

Fig. 4: GSM

VIII. PROCESS

A. Purging:

1) It is a process of removal of leftover combustible gases in the furnace to avoid overheating.
2) After the purging process, the ignition transformer and pilot SOV are turned on to establish the pilot flame.
3) In case of failure of establishment of pilot flame, which is sensed by the pilot flame sensor, an alarm is generated.
4) Similar to the above process, air SOV and oil SOV are turned on to establish main flame, which is then to be maintained for heating of burner.
5) A similar logic like the above is used by the main flame sensor to sense failure of main flame.
6) If pilot flame and main flame are not established within predetermined time , pilot SOV and air SOV are turned off, alarm blinks and hooter is turned on.
7) The alarm and hooter remains on until the fault has been acknowledged.
8) Using the Android application 'ELIPSE MOBILE', the fault is been notified in form of a text message to the interfaced cell phone.

IX. RESULT

Below are some SCADA screens which shows all the functions taking place in a burner, the status of inputs and outputs and the faults which are being acknowledged.

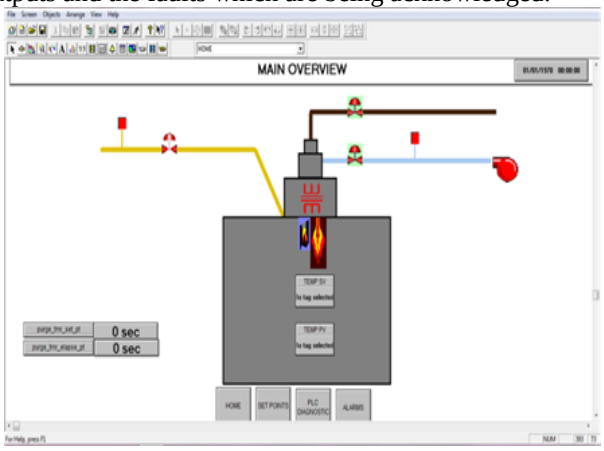

Fig. 5:

The above figure (e) is the main screen of the burner system. This is the Home screen, which shows all the processes taking place in the burner. Here the blue line is the pipeline for providing the air and brown for providing oil required for the combustion process and the yellow line is for generating the pilot flame to initiate the process. There are some valves present on each pipeline.

An ignition transformer is present to ignite the pilot flame. The blue flame is the pilot flame and the red one is the main flame.

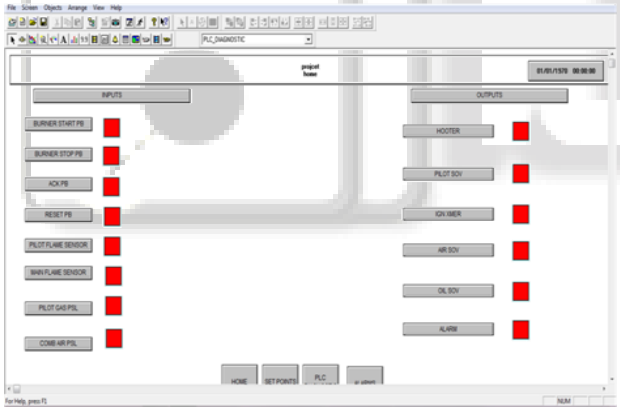

Fig. 6:

Figure (f) is the PLC Diagnostics screen, which shows all the inputs and outputs of the system. It shows the status of the inputs and outputs that takes place during the whole process. When the red color of a particular block becomes green it indicates that the particular block or I/O is ON.

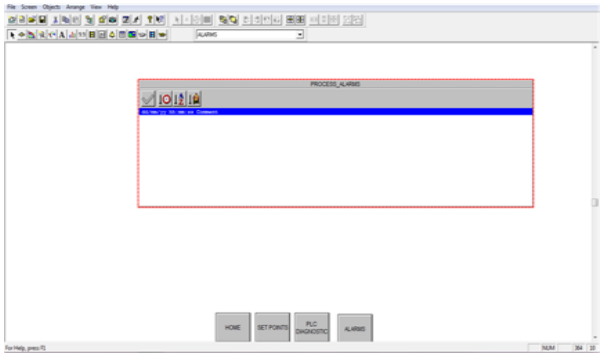

Fig. 7:

Figure (g) is the Alarm screen of the system. When any fault takes place in the burner system, there is an indication of the text message on this screen in red color. In all 1000 such alarm indications can be acknowledged and recorded with the date and time at which the particular fault has occurred.

X. CONCLUSION

In this paper, a system has been successfully designed that should prove very useful in the field of technology. Based on actual tests and evaluations, we believe the use of mobile telephones as interfaced with the computers offers much promise for a wide variety of applications. We learnt step by step approach to design SCADA and PLC based system. It is capable of logging the faults on a continuous basis and send text massages whenever a fault occurs with the help of GSM.

REFERENCES

[1] A.S. Gundale1, K.M. Vakani, P.D.R. Patnaik "Development of A web and GSM Based Monitoring and Controlling System for PLC Based Application", IJSRD-International Journal for Scientific Research & Development, Vol. 1, Issue 5, 2013.

[2] S.Sukhumar, P.Mukesh Aravind, L.Manivannan, P.Naveen Kumar and N.Suthanthira Vanitha, **"**GSM BASED AUTOMATIC TRIPCONTROL SYSTEM FOR ENERGY MANAGEMENT" International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 12, December 2013.

[3] Engin Ozdemir* Mevlut Karacor†, "Mobile phone based SCADA for industrial automation", ISA Transactions®, Volume 45, Number 1, January 2006.

