

Graphical System Design for Thermal Power Plant Monitoring and Intimation using GSM Technology

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Abstract— Monitoring and intimating of parameters such as temperature, pressure, level and turbine speed is an essential process in critically controlled environments of industries including the Thermal Power Plants. Thermal Power Plant needs continuous monitoring to work effectively. By using our traditional application it has some cons such as the instalment and maintenance cost is very high which can be overcome by our method. The objective of this paper is to control the plant performance by automatic monitoring of parameters such as temperature, pressure, level and turbine speed. Thermal Power Plant can be monitored continuously by sensors connected to ATMEGA 2560 and also we can GRAPHICALLY see the parameters value using LabVIEW. If any parameter exceeds the predefined values it will intimate using GSM technology. Authority can control the environmental factor of plant by simply sending control information to the controller connected to the Power Plant. It can be used in any industries where continuous monitoring is required. All these monitoring and intimation operations are performed by using ARDUINO, GSM, LabVIEW and various sensors.

Keywords— Arduino, GSM, LabVIEW, Level, Temperature, Pressure, and Speed

I. INTRODUCTION

Over the past twenty years the need for power is increasing rapidly. To overcome this demand many power plants are built of which Thermal power Plants are common. In Thermal Power plant continuous monitoring is required for safe operation. By using manual power we cannot continuously monitor for 24x7. So some methods are involved for automatic monitoring. Most of the traditional methods used for monitoring have high operating and maintenance cost. In order to overcome this drawback we are using Arduino (Atmega 2560) for automatic monitoring. In this setup we are giving set point to various parameters such as Temperature, Pressure, Level and Speed. It will automatically monitor all parameters and also we can graphically view the parameters value by using LabVIEW. If any parameter value reach above the set point value it will automatically intimate to higher authority with that para-meter description by using GSM (Global System for Mobile Communication) technology. Then the controller will send control instruction to the plant for safe operation. This is one of the effective method in monitoring the power plant with low cost.

II. EXISTING SYSTEM

In this research system all parameter are monitored continuously without virtual layout. And in some cases they use ZigBee for wireless communication and use pic microcontroller for operation. These Systems are having a problem that there is no graphical view about the status and also we cannot get any warning messages when we are at remote location.

III. PROPOSED SYSTEM

In this proposed paper we are using Graphical layout by using LabVIEW software. We are using GSM for wireless communication so we can receive status of power plant at remote area too. In this we are using Arduino Atmega 2560 microcontroller, which is more powerful and user friendly for programming. It has an open source software for programming and also it reduce the complexity of programming by simply using our native programming language.

IV. HARDWARE DESCRIPTION

A. Block Diagram

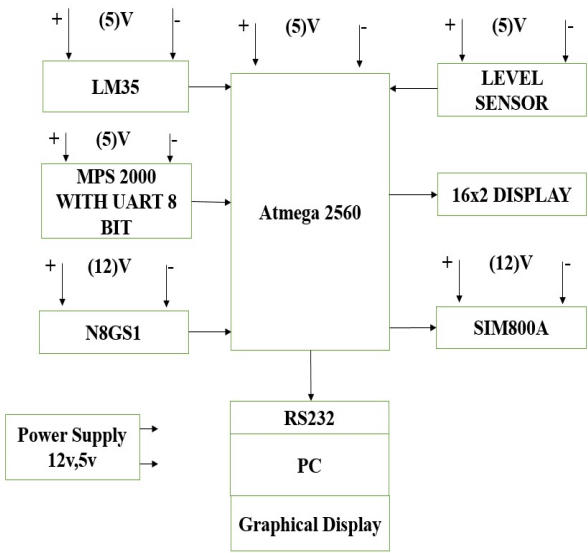


Fig. 1 Block Diagram

B. Atmega 2560

The Atmel Atmega 2560 is a high-performance, low-power microchip. It has 256KB of In-System programmable Flash with Read-While-Write capabilities, 4KB EEPROM, 8KB SRAM, 86 general purpose I/O lines of which 16 Analog and 54 Digital pins, 32 general purpose working registers, Real Time Counter(RTC), six flexible Timer/Counters with compare modes and PWM, four USARTs and 2-wire Serial Interface. It operates in 16 MHz at 4.5 to 5.5 V when operating temperature at -40 to +85°C. We can program this microcontroller by using Arduino Integrated Development Environment (IDE). It is an open source software and also supports native programming languages.

C. LM35

The LM35 is a Semiconductor based contact type temperature sensor. The LM35 is precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius scale i.e. 10mv/°C which means for every degree rise in temperature the output of LM35 will rise by 10mv. The LM35 does not require any external calibration or trimming. It is rated to operate over a -55 to + 150 °C with $\pm 1/4^\circ\text{C}$ accuracy.

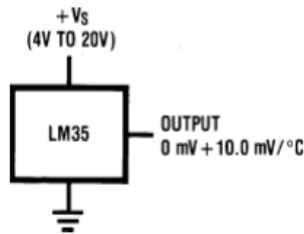


Fig. 2 Circuit Diagram of LM35

D. MPS 2000

MPS 2000 is a silicon pressor sensor with 6 pin dual in-line package. It provides low hysteresis, high reliability and stability. At constant voltage excitation, the MPS 2000 produces a voltage output that is linearly proportional to the input pressure. It is compatible with noncorrosive gases and dry air. Pressure ranges between 0 to 5.8 PSIG at wide operating temperature range of -40 to +85 °C. It is connected with UART board. The main reason for connecting pressure sensor with UART board is to send the data to Atmel Atmega 2560 microcontroller. We can transmit the data in either 8 bit or 10 bit. For this study we are using 8 bit for transmitting data.



Fig. 3 MPS 2000

E. N8GS1

N8GS1 is an inductive proximity switches used for non-contact detection of ferrous (metallic) objects. It sense for metal target in 8 mm. It operates within 4 to 40 V with maximum load current of 300mA and switching frequency at 20000Hz. It operates on logic NO with PNP. It is used to detect the speed of turbine. The main advantage of using this inductive type speed measurement is it compatible for all machines.



Fig. 4 N8GS1

F. Level Sensor

This circuit consists of 3 sensing probes which are dipped in water at different levels to sense the level of liquid. The sensing probe A which is at the bottom of tank which was given by 5 V supply and the remaining sensing probes are connected to the circuit. Depending upon the liquid level the sensing probes get excited which is directly proportional to the tank level. It is very simple and low cost and also we can able to measure level of oil and chemical. When the tank is full both the sensing probes C, B start conducting. If the tank is partially filled sensing probe B will conducting. If the tank is low or empty no probes will conduct. By this we can find level of tank. From this we can setup that when the tank level is too low we can set an indication easily with lower cost. By setting the input pin in Atmega 2560 as data input_pullup. This will sense the tank level easily.

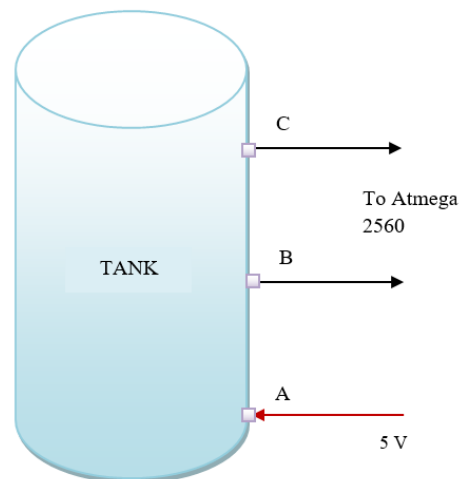


Fig. 5 Level Sensor

G. SIM800A

SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. It works on the input of 12 V. It has a one full function UART port, and can be configured to two independent serial ports. It can be used by AT commands for data stream.



Fig. 6 SIM800A

H. 16X2 Display

The usually utilized 16x2 LCD show uniquely crafted characters, numbers, letter sets, and extraordinary characters. It is used for the local monitoring. It will show the temperature, pressure, level and speed value in low level controlling unit. In this study we are displaying the current status of Temperature, Level, Pressure and Speed. This display is used for the person who is near to the controlling area.

I. USB to Serial/UART

USB to Serial/UART is used to send serial data to computer, which provides connection for RS232 output and TTL interface. In this TX pin of Atmega 2560 is connected to RX pin of this board. It will send Serial data to PV via VISA cable.



Fig. 7 USB TO SERIAL/UART

V. SOFTWARE DESCRIPTION

A. Arduino IDE

The Arduino Integrated Development Environment or Arduino IDE is a software that contains a text editor for writing codes, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It is an open source software that will allow user to programming the microcontroller in native programming languages that is similar to c and c++. It also have compiling and debugging option that allow user to check for an error and program the microcontroller without any error. It connects to Arduino and Genuino hardware to upload programs and communicate with them. It will also use to send AT commands for SIM800A module. In this we are communicating Atmega 2560 by Arduino IDE.

B. LabVIEW

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a system design platform and development environment for Graphical programming language. It supports for interfacing external devices such as camera, motor etc. It includes inbuilt virtual instruments for measuring and using programming to control some application. LabVIEW programs are called Virtual Instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeters. LabVIEW contains a comprehensive set of tools for acquiring, analysing, displaying, and storing data, as well as there are lot of tools that can be used for processing the data. It have data flow programming that is very user friendly to operate.

VI. FLOW CHART

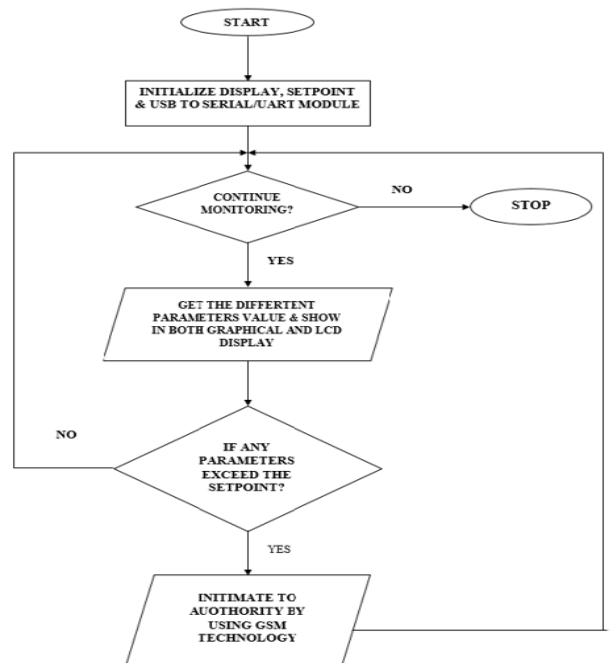


Fig. 8 Flow Chart

VII. HARDWARE DESIGN

In this research plan we use Arduino Atmel Atmega 2560 microcontroller operating volt of 5 V and frequency of 16MHz is used. It contains 16 Analog and 54 Digital I/O pins. The Analog pin A1 is connected to temperature sensor. The Digital pins (22, 23, 24, 25, 26, 27, 28, and 29) are connected to pressure sensor with UART 8 bit. The Digital pin 4 is connected to proximity sensor via NPN transistor. The Digital pins (52 and 53) is connected to level sensor probes. The digital pins (6, 7, 8, 9, 10, and 11) are connected to 16x2 LCD display. The TX1 pin is connected to RX pin of GSM module. Similarly TX2 pin is connected to RX pin of USB to UART/SERIAL board, which provides RS232 output to connect with PC. The Atmel Atmega 2560 microcontroller read all parameters value and process the data and send SMS through SIM800A if any abnormal situation was happened. It also send parameters value to LCD display and to PC for graphical display via LabVIEW.

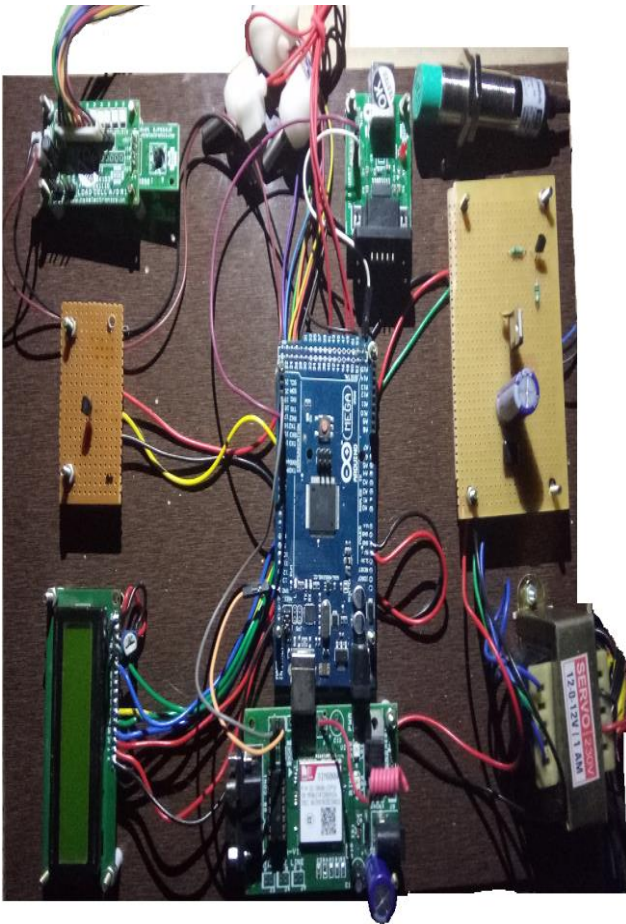


Fig. 9 Hardware Setup

VIII. GRAPHICAL DESIGN

Graphical design was created by using LabVIEW, which is a software platform for PC. In which user can virtually create an instrument. It has both front panel for monitoring and block diagram for circuiting. We can access the value from Atmel

Atmega 2560 via visa cable and monitor it. To do monitoring first we need to setup the sending port in Atmega 2560 and by using the USB to UART to convert into serial data and send to computer. Then setup the interface cable to the computer and connect with LabVIEW software. Then we need to get the serial data from the visa cable and convert it into parallel data for performing operation. To create the indicator Right click on the front panel to choose the needed indicators and controls. In the block diagram window we can choose the looping and other data flow programming for giving the interconnection for graphical view.

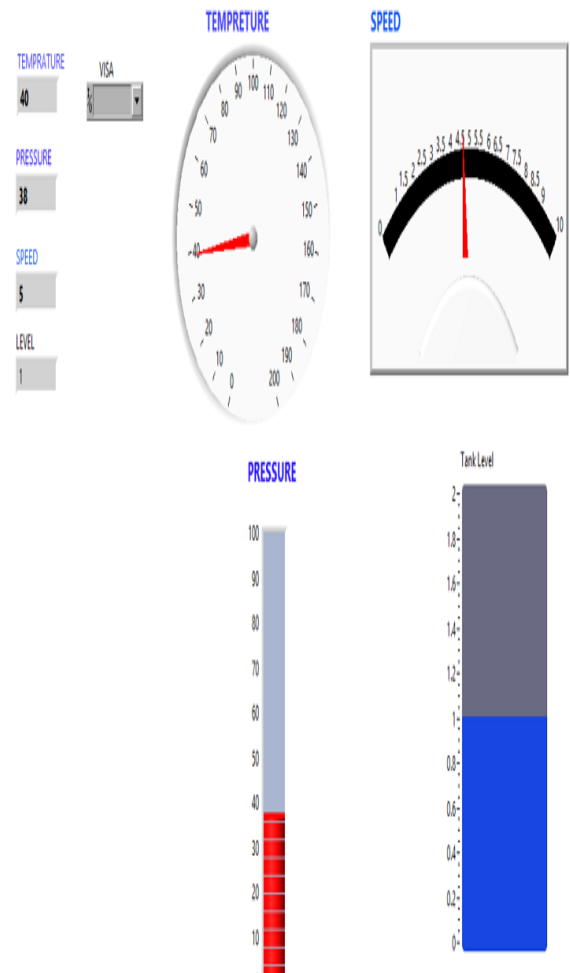


Fig. 10 Graphical View

IX. CONCLUSION

From this project we can able to monitor the Thermal Power Plant automatically, thus reduce the man work. And automatically intimate error if happened in Power Plant to higher authorities by using GSM technology. This will reach in remote place, so they can know about status of their plant easily. This will reduce the destruction caused by any abnormal conditions. This project is not only for Thermal Power plant it can also be used for any type of Industries where continuous monitoring is required by changing the monitoring parameters and its value.

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