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LABVIEW based thermal power plant Monitoring and controlling using GSM technology

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Abstract -At present, most of the Industries are shifting towards automation. In earlier days, the inspection and controlling processes were done through human workers. There is a possibility of human errors while measuring the parameters value. Lack of monitoring and controlling can affect humans and environment. So, in Thermal power station the monitoring and controlling process of the parameters is a challengeable task. As this plant has to work 24 hours, so it was quite difficult to monitor and control parameters in site at each and every moment without any issues. So reliable monitoring and controlling system is required. Therefore we are proposing this system by using Arduino and graphical representation of LabVIEW to monitor and control the parameters like boiler drum level and Steam temperature. LabVIEW will display the graphical representation, accurate values and waveform of the parameter variations. This system mainly consists Temperature sensor and Water level sensor. All the sensors data is processed using Arduino. When there is a sudden increase or decrease in the level, GSM module is used to alert the higher officials through Short Message Service (SMS).

Keyword- Arduino Uno, GSM, LabVIEW, Level sensorand Temperature sensor.

I. INTRODUCTION

Maintaining power system Operational parameter is very important for the health of power generating equipment and the utilization equipment at the customer and power plant require continuous monitoring and inspection at frequent intervals. The timely information about the variation in parameters like boiler drum level and steam temperature can be received from various devices by using embedded system. If the values of the parameters are increased or decreased than the reference value, Arduino will control the process to the normal condition [6].The major software, LabVIEW is used in this project to display the real time values with graphical representation of the parameters. GSM module is used to intimate the higher officials about the values of the parameter varied from set values through SMS [7].

II. EXISTING SYSTEM

In thermal power station, the boiler parameters such as water level, pressure, temperature is monitored using MATLAB tool [9]. These parameters are controlled by manual only. In this conventional type of monitoring if there is a chance of fault it can come to knowledge only after the occurrence of fault. Immediate alert system is not available. The data weremaintained only in log book so there is no possibility of effective data analysis for taking preventive action leading to production loss, workman hour. MATLAB is basically a scripted language and it is not applicable for the graphical representation. There is no automation system is available. ARM 8 processor was used for the controlling process. But it does not have its own IDE. So it is quite difficult to run [8].

III. PROPOSED SYSTEM

In order to overcome the existing problem the conventional proposed system is employed. The proposed system of this project is to monitor and control the boiler parameters by using the Arduino Uno controller. The Arduino controller for embedded applications is automotive for industrial control. The embedded controller is used for real time monitoring of data. In this conventional type of monitoring if there is a chance of fault it can come to knowledge before the occurrence of fault. GSM is used to intimate the person- in-charge about the fault occurred[3]. An automatic monitoring of boiler drum parameters such as water level and temperature are measured and it is displayed in the LabVIEW. The temperature level is measured by using temperature sensor [4]. The Water level of the boiler is one of the main parameter. It can be measured by using water level sensor[2]. All the output is given to the Arduino and if it reaches the threshold level it is automatically controlled by using the Arduino and the output is displayed in the LabVIEW as graphical representation. In the existing system the output was only in the form of waveforms. So the LabVIEW help us to overcome this problem by displaying graphical view.

3.1 PARAMETER DISCRIPTION

3.1.1 HARDWARE DESCRIPTION

3.1.1.1 ARDUINO MICROCONTROLLER

The Arduino Uno board is a microcontroller in light of the ATmega328. It has 14 advanced in-put/yield sticks in which 6 can be utilized as PWM out-puts, a 16 MHz clay resonator, an ICSP header, a USB association, 6 simple information sources, a power jack and a reset catch. This contains all the needed help required for microcontroller. Keeping in mind the end goal to begin, they are essentially associated with a PC with a USB link or with an AC-to-DC connector or battery.

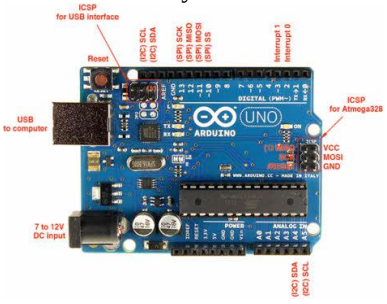

Fig 1. Arduino Uno board

Arduino Uno Board fluctuates from every other board and they won't utilize the FTDI USB-to-serial driver contribute them. It is highlighted by the Atmega16U2 (At-mega8U2 up to variant R2) customized as a USB-to-serial converter.

3.1.1.2 TEMPERATURE SENSOR

The Temperature Sensor LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.

Fig 2. LM35 Temperature sensor

The LM35 device does not require any external calibration or trimming to provide typical accuracies of±¼°C at room temperature and ±¾° C over a full −55°C to 150°C temperature range.

3.1.1.3 WATER LEVEL SENSOR

Fig 3. HR-SC04 Level sensor

Water sensor block is intended for water detection, which can be generally utilized as a part of detecting precipitation, water level, and even fluid spillage. Associating a water sensor to an Arduino is an awesome method to distinguish a hole, spill, surge, rain, and so on. It can be utilized to recognize the nearness, the level, the volume and additionally the nonattendance of water. While this could be utilized to remind you to water your plants, there is a superior Grove sensor for that. The sensor has a variety of uncovered follows, which read LOW when water is identified. In this part, water level sensor will be connected to the Digital Pin number 8 on Arduino and will enroll the extremely convenient LED to help identify when the water sensor comes into contact with a wellspring of water.

3.1.1.4 GSM

GSM remains for Global System for Mobile Communication. It is an advanced cell innovation utilized for transmitting portable voice and information administrations. GSM is a circuit-exchanged framework that partitions each 200 kHz channel into eight 25 kHz schedule openings. GSM works on the portable correspondence groups 900 MHz and 1800 MHz in many parts of the world. In the US, GSM works in the groups 850 MHz and 1900 MHZ. GSM impacts usage of narrowband to time Division Multiple Access (TDMA) framework for transmitting signals.

Fig 4. GSM Module

GSM was produced utilizing advanced innovation. It has a capacity to convey 64 kbps to 120 Mbps of information rates. GSM gives fundamental to cutting edge voice and information administrations including wandering administration. Meandering is the capacity to utilize your GSM telephone number in another GSM arrange.

3.1.1.5 DC FAN

Fig 5. DC Fan

A mechanical fan is an electrically fueled machine used to make stream inside a liquid, normally a gas, for example, air. A fan comprises of a pivoting arrangement of vanes or cutting edges witch follow up on the air liquid. The turning gathering of sharp edges and center point is known as an impeller, a rotor, or a sprinter. Ordinarily, it is contained inside some type of lodging or case. This may coordinate the wind current or increment security by keeping objects from reaching the fan sharp edges.

3.1.1.6 SOLENOID VALVE

Fig 6. Two port solenoid valve

A solenoid valve is an electromechanically worked valve. An electric current controls the valve through a solenoid because of a two port valve, the core is turned on or off by virtue of a three port valve, the overflowing is traded between the two outlet ports. Various solenoid valves can be set together on a complex.

3.1.2 SOFTWARE DESCRIPTION

3.1.2.1 LabVIEW

LabVIEW (short for Laboratory Virtual Instrumentation Engineering Workbench) is a stage and advancement condition for a visual programming dialect from National Instruments. The graphical dialect is named "G". Initially discharged for the Apple Macintosh in 1986, LabVIEW is commonly utilized for information procurement, instrument control, and modern robotization on an assortment of stages including Microsoft Windows, different kinds of UNIX, Linux, and Mac OS X. The most recent adaptation of LabVIEW is rendition LabVIEW 2011. Visit National Instruments at www.ni.com. The code documents have the expansion ".vi", which is a shortened form for "Virtual Instrument". LabVIEW offers heaps of extra Add-Ons and Toolkits.

3.1.2.2 ARDUINO IDE

The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a word processor for composing code, a message region, a content reassure, a toolbar with catches for basic functions and a progression of menus. It interfaces with the Arduino and Genuino equipment to transfer programs and speak with them. Projects composed utilizing Arduino Software (IDE) are called draws.These representations are composed in the content manager and are spared with the document expansion .ino.

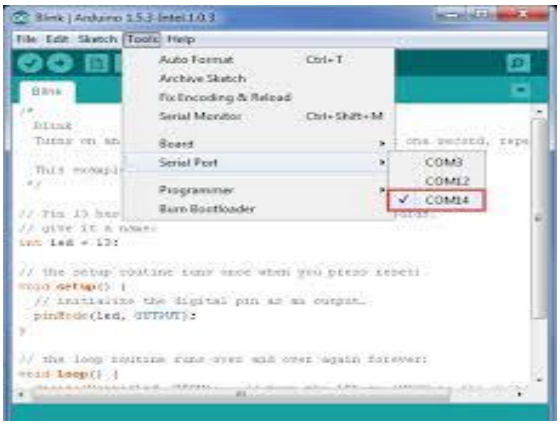

Fig 7. Arduino IDE

The manager has highlights for cutting/sticking and for looking/supplanting content. The message region gives input while sparing and sending out and furthermore displays blunders. The comfort shows content yield by the Arduino Software (IDE), including complete mistake messages and other data. The base right-hand corner of the window shows the configured board and serial port. The toolbar catches enable you to check and transfer programs, make, open, and spare outlines, and open the serial screen.

IV. BLOCK DIAGRAM

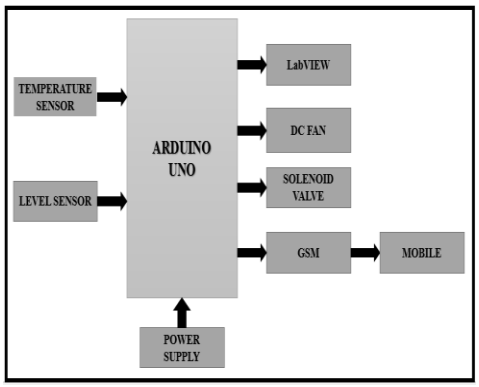

Fig 8. Block diagram

In the above Block diagram Temperature sensor and Level sensor are connected as input to the controller Arduino. The power supply is given to an Arduino which provides voltage of about +5v. DC Fan and Solenoid valve are connected at the output pin of the Arduino and it will act with respect to the input of the sensors. At the same time, LabVIEW and GSM are also connected at output end which provide real time values of parameters with graphical representation and send message to intimate higher officials.

V. CIRCUIT DIAGRAM

The circuit had been designed with Arduino, Temperature sensor, Level sensor, GSM module, DC fan, led, solenoid valve and Driver circuit. Temperature sensor and Level sensor are connected to the input pin of an Arduino. It senses the steam temperature and the level of the water in the boiler drum and gives continuous input to an Arduino. In Arduino, the threshold value of the temperature and water level are mentioned in the coding.Whenever there is a change occurs in the values of the steam temperature, driver circuit connected at the output will starts switch ON to rotate the DC Fan [1] and if the water level changes from the reference value, the LED connected at the output will starts glowing until the level comes to the normal condition as well as the solenoid valve will be closed or opened automatically.

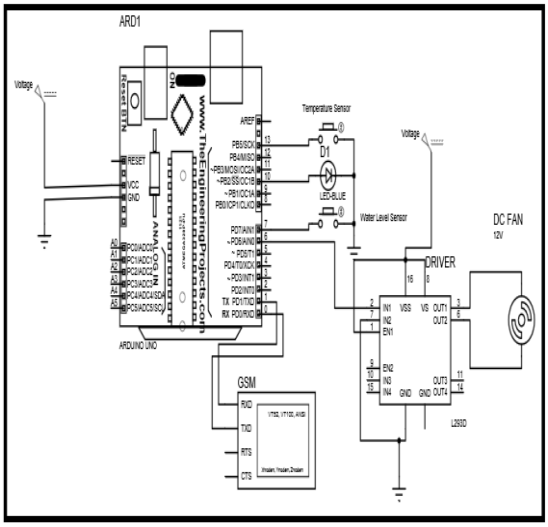

Fig 9. Circuit diagram

Whenever there is a change in the values of the parameters from the set value, GSM module connected at the output pin will send a message to intimate the in-chargers. These process are continuously monitored with help of LabVIEW by interfacing it to an Arduino[10]. It will displays the real time values of the parameters as well as the graphical representation of the boiler water level and the steam temperature.

VI. SIMULATION

In the above simulation, two buttons are connected at the output pin of the Arduino. When the temperature senses the temperature of the steam which varied from the set points in the program of an Arduino, the button1 will comes to the state high which will automatically switch ON the driver circuit to rotate the fan and reduces the steam temperature.If

the level sensor senses the level which varied from the reference value, the button2 will comes to the state high which will leads to glow LED simultaneously close the solenoid valve and also alert the person-in-charge through GSM.

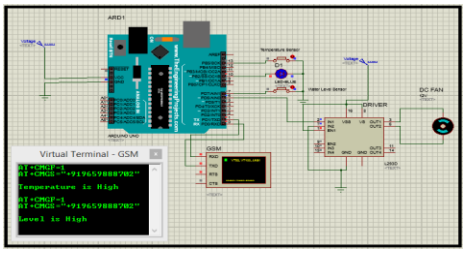

Fig 10. Simulation with Proteus

VII. RESULT AND DISCUSSION

7.1 LAbVIEW

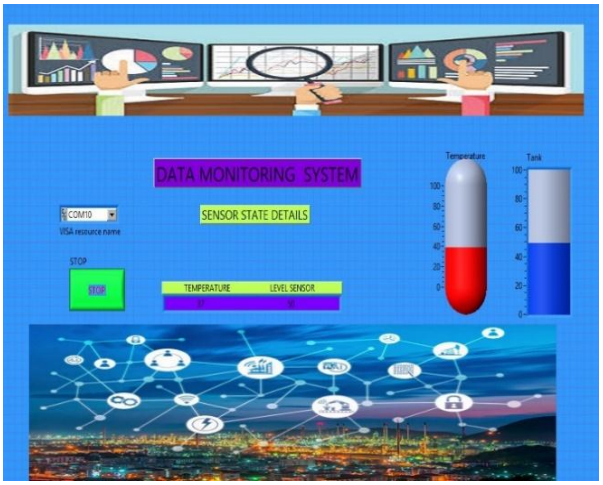

Fig 11. LabVIEW front panel

Using the front panel various parameters are monitored. In block panel, respective blocks are connected to design the front panel. This front panel indicates the parameters either normal or abnormal condition in graphical representation as well as the real time values by using LabVIEW. Now, this image represents the normal conditions of the Boiler drum level and the steam temperature. There is no program coding for this output. It receives the status of parameter continuously by using RS232 cable.

7.2 ADVANTAGES

- This is fully automated.
- More applicable for measuring cycling performance
- The LabVIEW is user friendly.
- Safe and secure.
- Miniaturization.
- Provide accurate results.

7.3 DISADVANTAGES

- Cost high
- Requires internet.

7.4 APPLICATION

- Atomization area
- Agricultural field.
- Industrial area
- Also day to day fitness monitoring is applicable

7.5 FUTURE SCOPE

- Maintaining database of the parameters values in LabVIEW using excel sheet.

VIII. CONCLUSION

In this project, the boiler drum parameters like temperature and water level can be monitored and controlled automatically by using Arduino controller. The parameter variations of normal and abnormal conditions are represented graphically represented by using LabVIEW [5]. The boiler water drum level and steam temperature plays an important role in thermal power station. The real time values of the parameters can be received by using Effective communication medium. GSM technology is used for sending the information to the person –in-charge.

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