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POWER PLANT MONITORING AND CONTROL USING GSM MODEM

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ABSTRACT

An embedded based power plant boiler automation using GSM is a project which shall be used for monitoring a given industry's boiler from any place all over the world where GSM network is available. In this project, a system of a number of boilers supplied by a main water tank has been proposed. The water level in the main tank is controlled by a water level sensor, each boiler has two pipes, one is inlet other one is outlet and the pipes' valves are controlled by some temperature sensors located in each boiler. From the GSM mobile phone, the user will be able to get information about the current temperature in any boiler by simply sending a boiler identification number. When the temperature inside any boiler reach a maximum presented value, the system will send a SMS to the user informing that the maximum temperature has been reached. All these control process are achieved by using a PIC microcontroller, GSM modem, sensors and different interfacing circuits.

Keywords: Power plant, Temperature, Sensors, Microcontroller and GSM

1. INTRODUCTION

In excess of the years the require for high quality, better effectiveness and automatic machinery have improved in the industrial region of power plants. Power plants have need of continuous monitoring and check at frequent intervals. There are possibilities of errors at measuring and various stages involved with human workers and also the lack of few features of microcontrollers. Hence this paper takes a truthful attempt to explain the advantages the companies will face by implementing automation keen on them. The boiler control which is the most significant partition of any power plant, and its automation is the accurate effort of this paper. Power plant section is one of most important department in the industry. There it is having number of boiling section. This boiling section produces the high temperature water of the steam level temperature. This steam level temperature is used for power generation and the steam waters are applied to the turbine section. After the power is generated, steam waters are supplied to various plants for reuses. If the supply of the high temperature is reduced to low temperature, it will be used for all other plants which needs the low temperature. Here, we are automation the all boiler temperature and water tank levels. And also measure and identify the boiler in flame sensing. If the all measurement data's are monitoring and controlled, and also send the SMS for increasing set values of temperature, water level and flame sensing using GSM module [9].

2. EXPERIMENTAL DESCRIPTION

2.1 Hardware Setup

PIC microcontroller 16F877A of operating volt of 5V and frequency of 10MHz is used for this study. It contains five ports A, B, C, D and E. Port A is an analog channel, which is connected to the temperature sensors. Ports B in first four pins (B0, B1, B2, B3)are connected to ULN 2003 (operating volt-12 V) relay driver IC that is further connected to the relay and last four pins (B4, B5, B6, B7) are connected to DTMF decoder. Port D is connected to the LCD. PIC microcontroller port pin Rx & TX is connected to a serial communication driver IC Max 232 which is further connected to serial port connector. This serial port connector can be connected to the GSM. The main objective of this project is to measure the boilers temperature tank level and flame sensor measured in analog form. A circuit, having IC-LM 35 temperature sensors measures the temperature of the boilers and having the water tank level measures the level of the water tank. And also having the flame sensor measure the boiler in flaming. The obtained temperature, level and flame measuring data are transferred through the PIC microcontroller. The microcontroller read the available data and processed [7].

➢ Interface the temperature sensor, DTMF decoder, LCD, Relay Driver and MAX 232 serial port driver with PIC microcontroller

➢ Transfer the parameter values are interfacing to PIC microcontroller and also send the parameter values through GSM.

3. HARDWARE DESCRIPTION

3.1 Block Diagram of PIC interfacing Figure

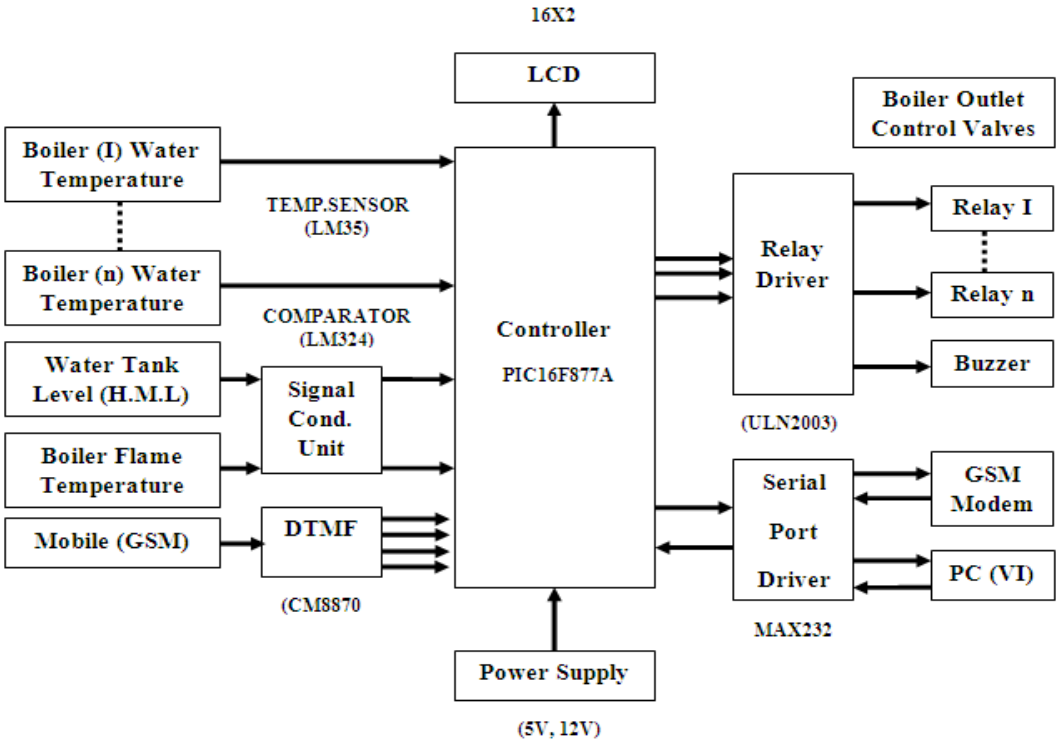

Fig 1: Block Diagram of Power Plant Boiler Automation

3.2 Temperature Measurement Descriptions

1) Principle of Temperature: Temperature is the degree of hotness or coolness of a body. When the temperature changes the internal resistance also changes to the corresponding material [6,7].

2) Sensing Device: A sensor is call transducer. The output of the transducer is in the form of voltage current, resistance, or capacitance. The block diagram summarizes the above discussion.

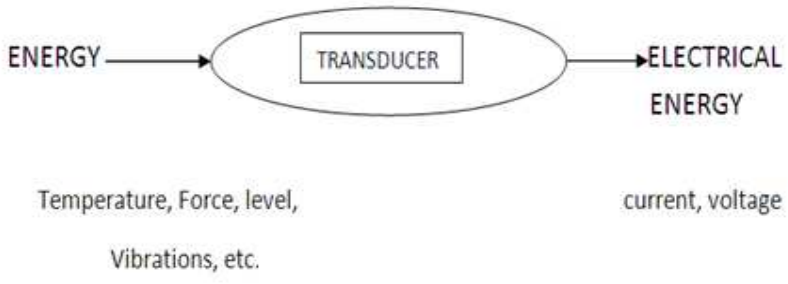

Fig 2: Temperature Measurement Diagram

In this development, high temperature is calculated; temperature measurement is significant in industry. In industry, there are different types of high temperature measurement, according to the variety of temperature. For example, LM35 is used to measure the temperature in the range of -55˚C to +150˚C. . The LM35 series are precision integrate-circuit temperature sensors whose output voltage is linearly proportional to the Celsius high temperature. The LM35 hence has an improvement more than linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. If we want to measure temperature greater than 1000˚C we have to use Thermocouples. [9,10]

3.3 Flame Detector

The flame detector is designed for use where open flaming fires may be expected. It responds to the light emitted from flames for the duration of fire. The detector discriminates connecting flames and other light sources by responding only to particular optical wavelengths and flame flicker frequencies. This enables the detector to avoided false alarms due to such factors as flicking sunlight.

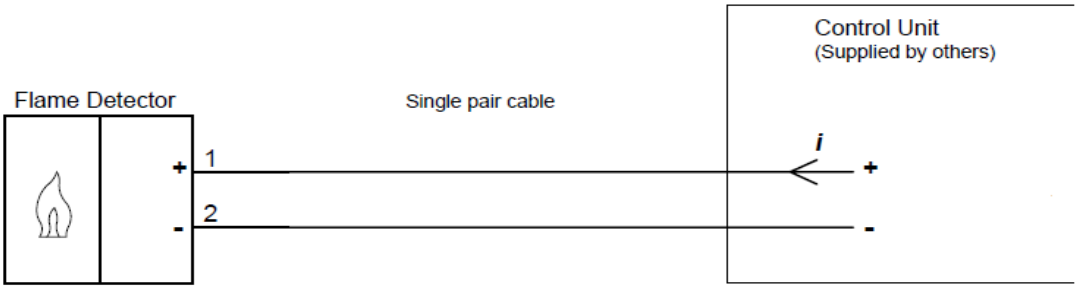

Fig 3: Basic 2 Wire Connection Diagram

1) Functional Description: The MT8870D monolithic DTMF receiver offers small size, low power consumption and high performance. Its architecture consists of a band split filter section, which separates the high and low group tones, followed by a digital counting section which verifies the frequency and duration of the received tones before passing the corresponding code to the output bus [1].

2) Filter Section: Separation of the low-group and high group tones is achieved by applying the DTMF signal to the inputs of two sixth-order switched capacitor band pass filters, the bandwidths of which correspond to the low and high group frequencies. The filter section also incorporates notches at 350 and 440 Hz for exceptional dial tone rejection (see Figure 4). Each filter output is followed by a single order switched capacitor filter section which smooth's the signals prior to limiting. Limiting is performed by high-gain comparators which are provided with hysteresis to prevent detection of unwanted low-level signals. The outputs of the comparators provide full rail logic swings at the frequencies of the incoming DTMF signals [2].

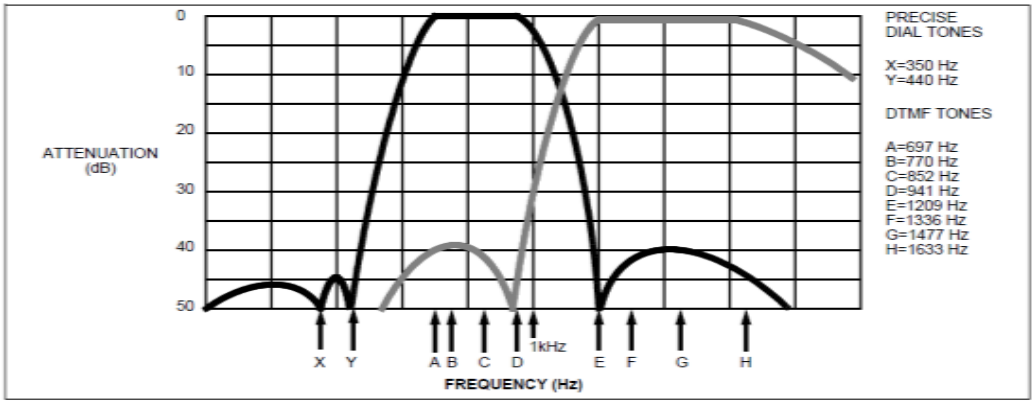

Fig 4: Filter Response

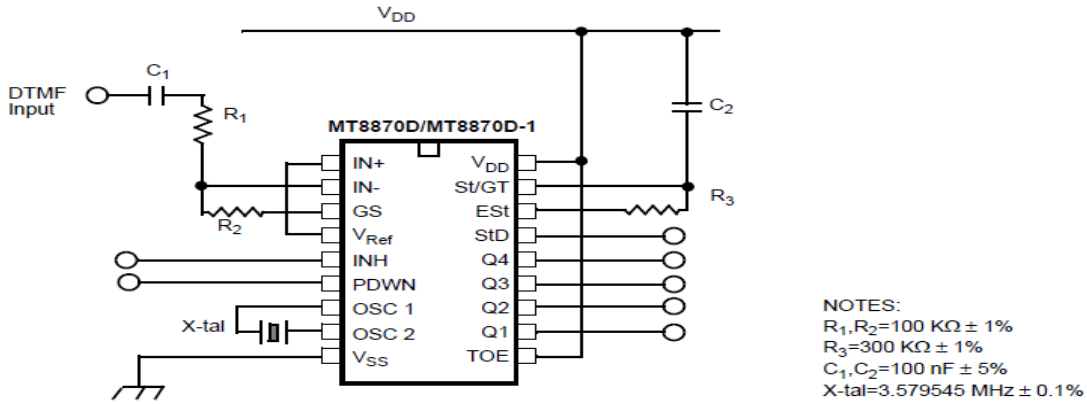

Fig 5: Single-Ended Input Configuration

A. MPLAB

The program is developed in Embedded C in MPLAB IDE. MPLAB Integrated Development Environment (IDE) is an integrated toolset for the development of embedded application employing Microchip's as well as PIC. MPLAB is a authoritative, feature rich growth tool for PIC micro controllers. It's construction to provide the programmer with the easiest possible solution of developing applications for embedded system. PIC micro controller is the most popular of 8-bit chip in all in excess of the world, if it's used for extensive diversity of applications, if the prized for efficiency. It's the natural choice for developing embedded systems, if the boards are set of hardware components.

B. Proteus VSM

Traditionally, circuit simulation has been a noninteractive affair. In the early days, net lists were prepared by hand, and output consisted of reams of numbers. If you were lucky, you got a pseudo-graphical output plotted with asterisks to show the voltage and current waveforms. PROTEUS VSM brings you the best of both worlds. It combines a superb mixed mode circuit simulator based on the industry standard SPICE3F5 with animated component models. And it provides an architecture in which additional animated models may be created by anyone, including end users. Indeed, many types of animated model can be produced without resort to coding. Consequently PROTEUS VSM allows professional engineers to run interactive simulations of real designs, and to reap the rewards of this approach to circuit simulation.

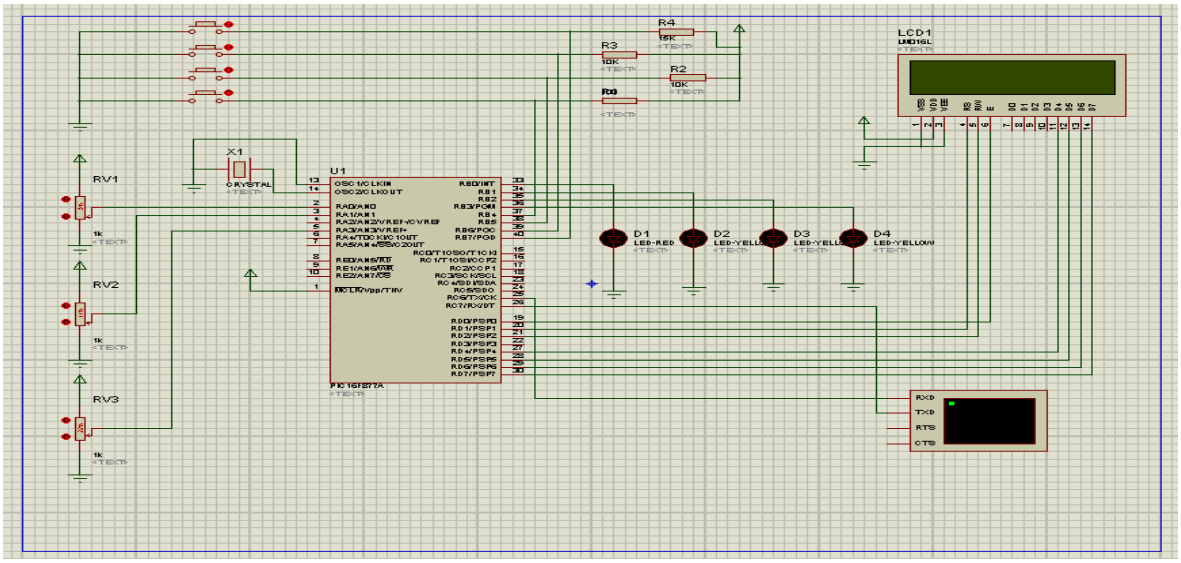

Fig 6: Circuit Diagram

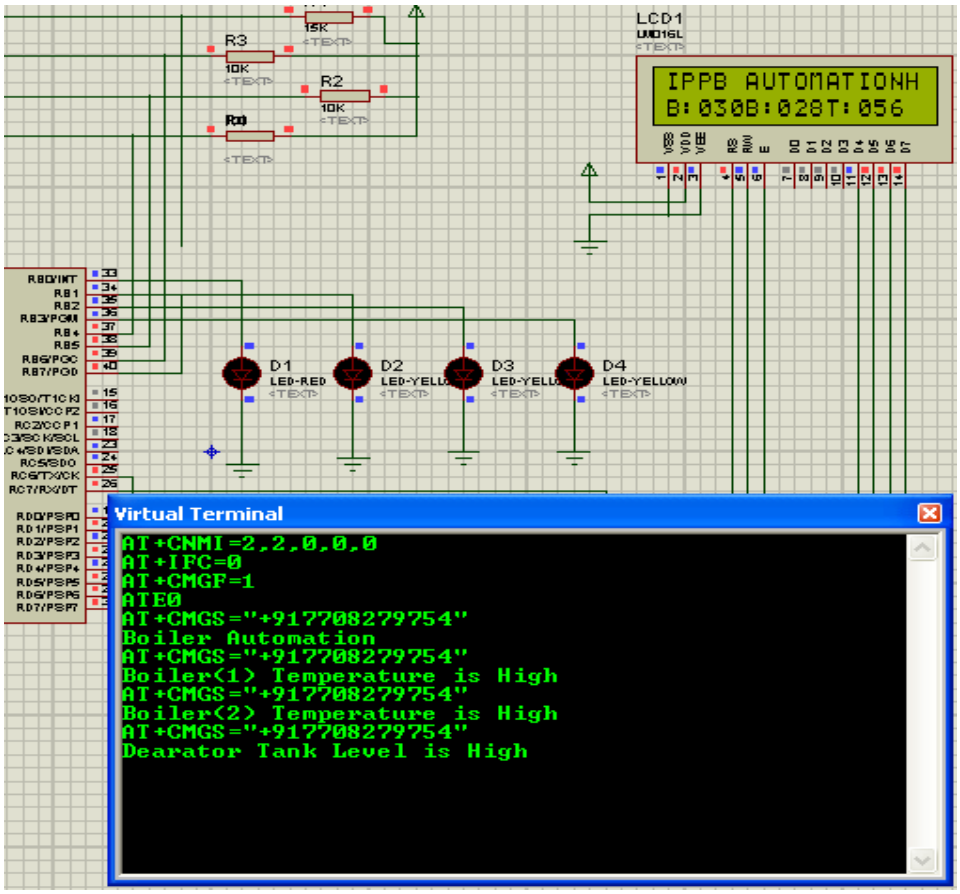

Fig 7: Monitoring the LCD and GSM Comman

C. PCB Layout and Description

PCB Design for PIC Micro controller: The PCB was designed by using the EAGLE editions. We can add an auto router module or a schematic editor to the design Editor. The design Editor, which allows to design in print Circuit Boards. Our PCB board is having the facilities of serial port interface with the LCD display. LM35 temperature sensors and relays interfacing and it are having the feature of all interfaces [6].

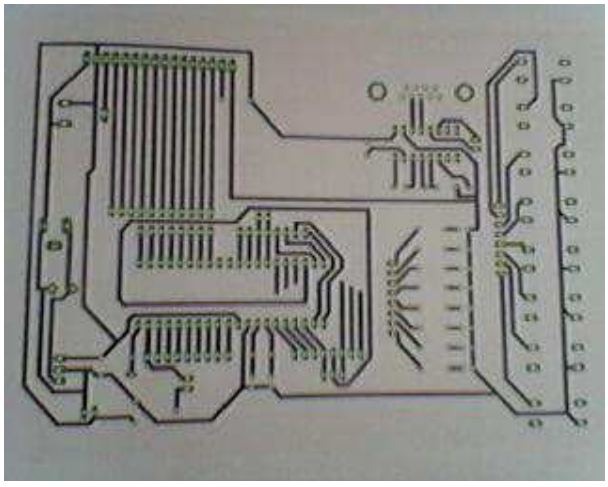

Fig 8: PCB Layout for PIC Micro controller

5. RESULT AND DISCUSSION

We measured the temperature, water tank level and flame sensing of our industrial power plant boiler automation. Sensing was done by sending every possible command to the Boiler and observed the Boiler's response. We also measured the Boiler's response with the incorrect message format. Figure 5 shows the Boiler tested with "Status" command. The As shown in the figure 5, the Boiler automation replied with the status of Serial Port to GSM and the current Boiler temperature. The result of this measuring is as expected. Figure 5 shows the message received by Power Plant Boiler Operating Engineer when the Boiler temperature is above 80°C or below 30°C, when the Water Tank Level is High Level or Low Level and when the Boiling Flame is go to High Detection. As shown, the PIC Micro controller with GSM sent a warning message to the Boiler Operating Engineer with the current Boilers temperature and water tank level. For all measuring scenario, in general, the Boiler automation can work well according to our specification and expectation. The measuring results are shown in Table 1 and

Table 1: Water Tank Level Measured Result

Sl. No.	Actual Voltage	Water Tank Indication
1	Below 1.5V	Low Level
2	2.5V	Medium Level
3	Above 4.5V	High Level

Table 2: Boiled Water Temperature Measured Result

Sl. No.	Actual Voltage	Output Voltage in mV	Temperature Value in Degree
1	0.30	300	30°C
2	0.35	350	35°C
3	0.40	400	40°C
4	0.45	450	45°C
5	0.50	500	50°C
6	0.55	550	55°C
7	0.60	600	60°C
8	0.65	650	65°C
9	0.70	700	70°C
10	0.75	750	75°C
11	0.80	800	80°C
12	0.85	850	85°C
13	0.90	900	90°C

The most important aspect of any power plant is the boiler control. Several techniques can be implemented to control the boiler in power plant. The method that has to be used relies on varied objectives like superior quality, increased efficiency, high profit and other such points depending upon the purpose of the company that implies it. With the prime objective of catering to these necessities and the needs of the industrial sector, significance has been given here to automation.

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REFERENCES

[1] Rajkamal. Embedded Systems Architecture, Programming and Design, TMH, 2008.

[2] Nagoor Kani A. Control System, First Edition.

[3] Curtis J. Process Control Instrumentation Technology, Fourth Edition.

[4] Jain RK. Mechanical and Industrial Measurement, Sixth Edition, Khanan Punlications, 2003.

[5] PIC Microcontrollers. Programming in C,Milan Verle,Number of pages: 336, Publisher: mikroElektronika; 1st edition (2009), Language: English.

[6] Seborg DE, Edgar TF, Mellichamp DA. Process Dynamics and Control: John Wiley & Sons, 2004.

[7] Sharma SC, Gupta S. Distributed Control System and its futures cope. IPPTAJ 2003;15(2): 61-65.

[8] Liptak BG. Instrumentation Engineer's Handbook: Process Control (Chilt Book Company I Radnor, Pennsylvania) 1999; 705-750.

[9] Gowri Shankar K. Control of Boiler Operation using PLC–SCADA. Proceedings of the International Multi Conference of Engineers and Computer Scientists 19-21 March, 2008.

[10] PIC 16F877 DATA Sheet.

[11] http://en.wikipedia.org/wiki/embedded systems.

