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Embedded System Based Laboratory Thawing Path Boiler Automation Using GSM Technology

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ABSTRACT

An embedded based laboratory thawing path boiler automation using GSM is a project which shall be used for monitoring a given all hospital's boiler from any place all over the world where GSM network is available.

In this project, a system of a number of boilers are arranged in the thawing path water tank has been proposed. The thawing path water level in the tank is controlled by a water level sensor, each boiler has the sensors 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 reaches a minimum value to maximum presented value, the system will send an SMS to the user informing that the maximum temperature has been reached.

All these control processes are achieved by using a PIC microcontroller, GSM modem, sensors and different interfacing circuits.

Keywords :— Boilers, Temperature, Sensors, Microcontroller, and GSM

I. INTRODUCTION

In excess of the years, they require high quality, better effectiveness, and automatic machinery have improved in the trial region of laboratories. Laboratories have need of continuous monitoring and check at frequent intervals. Since man's involvement in measuring is more likely to be wrong. This is why microcontroller is used to fix this. Hence this paper takes a truthful attempt to explain the advantages the hospitals will face by implementing automation keen on them. The boiler control which is the most significant partition of any laboratory and its automation is the accurate effort of this paper.

Laboratory department is one of the most important departments in the hospital. There it is having a number of analogizing section. Here one of the analogizing sections is boiling section. This boiling section produces the temperature water of the high-level set (37°C) temperature. This high-level temperature is used for refreezing the blood bags and the high-temperature waters are continuously heated and maintain the set temperature in the boiling section. After the refreezing the blood bags, which blood bags are used for various analogizing measurement for patents treatments.

Here, we are automation the all boiler temperature and thawing path water tank levels. And also measure and identify the boiler heat sensing. If all measurement data's are monitoring and control, and also send the SMS for increasing set values of temperature, thawing path water tank level and heat sensing using GSM module.

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II. EXPERIMENTAL DESCRIPTION

A. Hardware Setup

In this project used PIC microcontroller 16F877A. If the operating volt is 5V and frequency is 10MHz. In this PIC microcontroller have five ports are available (Port A, B, C, D, and E). The temperature sensor is connected in the analog channel of Port A. Then the relay driver ULN2003 IC and DTMF IC are connected in the Port B. The LCD display is connected in the Port D.

PIC microcontroller port pin Rx & T_X is connected to a serial communication driver IC Max 232 which is further connected to the serial port connector. This serial port connector can be connected to the GSM.

B. An objective of the Project

The main work of this project is to measure the thawing path boilers temperature, thawing path water tank level and heat sensor measured in analog form. A circuit, having PT100 temperature sensors measures the temperature of the thawing path boilers and having the thawing path water tank level measures the level of the thawing path water tank. And also having the heat sensor measure the boiler in heating. The temperature, level, and heat measuring data's are sending to PIC microcontroller through serial port communication. The PIC microcontroller is read the available data and processed.

- The temperature sensor, Dual Tone Multiple Frequency decoders, LCD, Relay Driver and Serial port driver IC's are interface with PIC microcontroller.
- The measured sensors values are interfacing with PIC microcontroller and also that sensors values are sent to GSM.

III. HARDWARE DESCRIPTION

A. Block Diagram of PIC interfacing

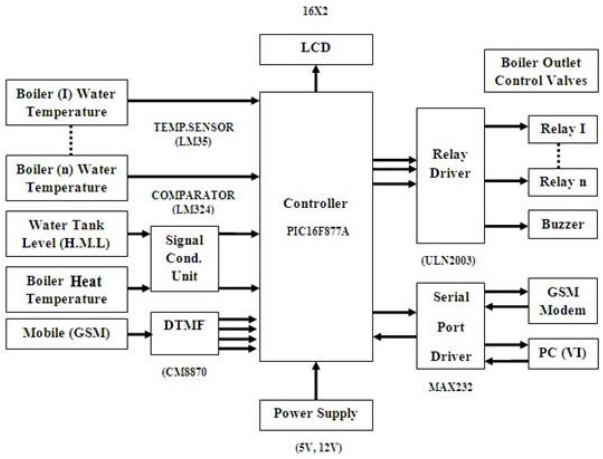

Fig 1. Block Diagram of Laboratory Thawing Path Boiler Automation

B. Temperature Measurement Descriptions

1) The principle of Temperature: Temperature is the degree of heat or coolness of a body. When the temperature changes the internal resistance also changes to the corresponding material.

2) Sensing Device: A transducer is call sensor. The transducer output form is voltage, current, resistance or capacitance.

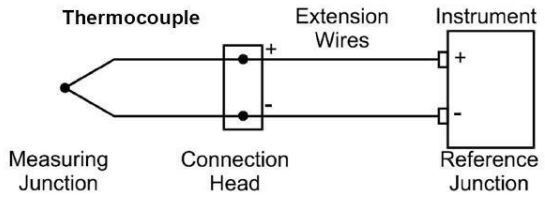

Fig 2. Temperature Measurement Diagram

In this development, water tank temperature is calculated; temperature measurement is significant in hospital. In the hospital, there are different types of temperature is measured, according to the variety of temperature instrument.

For example, the temperature of the thermocouple sensor is to measure the resistance of a platinum element. The measured resistance of 100 ohms at 0 °C and 138.4 ohms at 100 °C.

C. Heat 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 the 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 avoid false alarms due to such factors as flicking sunlight.

Fig 3. Basic 2 & 3 Wire Connection Diagram

D. DTMF Decoder

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.

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 bandpass 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.

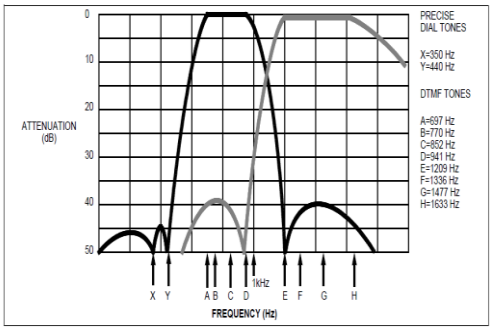

Fig 4. Filter Response

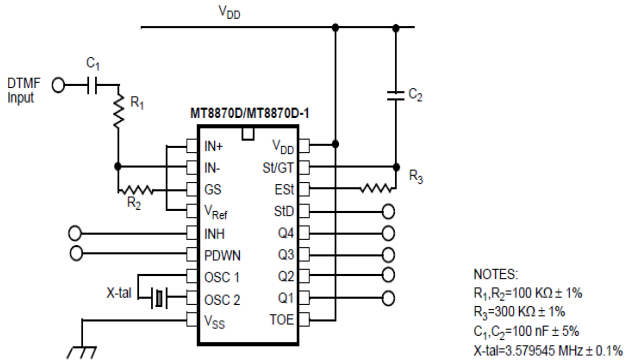

Fig 5. Single-Ended Input Configuration

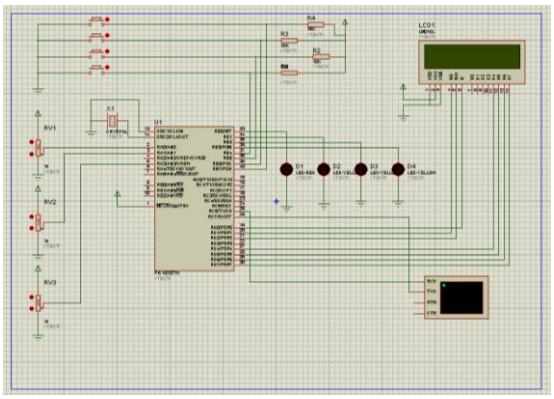

Fig 6. Circuit Diagram

IV. SOFTWARE DESCRIPTION

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 an authoritative, feature rich growth tool for PIC microcontrollers. It's construction to provide the programmer with the easiest possible solution of developing applications for the embedded system.

PIC microcontroller is the most popular of the 8-bit chip in all in excess of the world if it's used for an 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 non-interactive affair. In the early days, netlists 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.

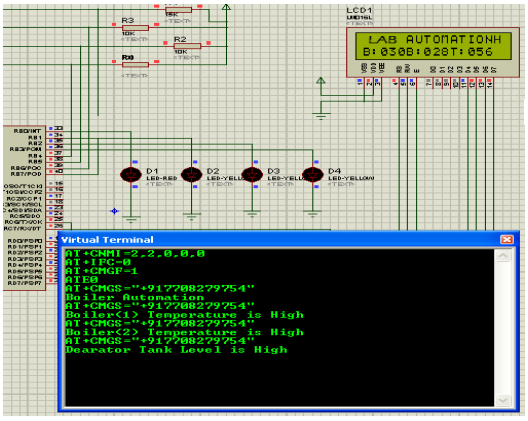

Fig 7. Monitoring the LCD and GSM Command

C. PCB Layout and Description

PCB Design for PIC Microcontroller: 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 designing in print Circuit Boards. Our PCB board is having the facilities of serial port interface with the LCD display. PT100 temperature sensors and relays interfacing and it are having the feature of all interfaces.

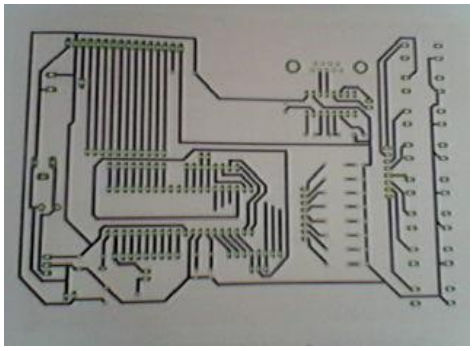

Fig 8. PCB Layout for PIC Microcontroller

V. RESULT AND DISCUSSION

We measured the temperature, thawing path water tank level and heat sensing of our hospital laboratory thawing path boiler automation. Sensing was done by sending every possible command to the Boiler and observed the Boiler's response. We also measured the thawing path boiler's response with the incorrect message format. Figure 7 shows the Boiler tested with "Status" command. The as shown in figure 7, the thawing path boiler automation replied with the status of Serial Port to GSM and the current thawing path boiler temperature.

The result of this measuring is as expected. Figure 7 shows the message received by laboratory thawing path Boiler Operating lab technical Engineer when the Boiler temperature is above 37°C or below 37°C, when the Thawing path water tank Level is High Level or Low Level and when the Boiling water temperature is going to High Detection. As shown, the PIC Microcontroller with GSM sent a warning message to the Boiler Operating lab technical Engineer with the current Boilers temperature and thawing path water tank level. For all measuring set-up, in general, the Boiler automation can work well according to our specification and expectation. The measured output results are shown in Table 1 and 2.

TABLE. 1
THAWING PATH BOILED WATER TEMPERATURE MEASURED RESULT

Sl. No.	Actual Voltage	Output Voltage in mV	Temperature Value in Degree
1	0	0	0˚C
2	0.01	10	1˚C
3	0.02	20	2˚C
4	0.03	30	3˚C
5	0.04	40	4˚C
6	0.05	50	5˚C
7	0.06	60	6˚C
8	0.07	70	7˚C
9	0.08	80	8˚C
10	0.09	90	9˚C
11	0.10	100	10˚C
12	0.15	150	15˚C
13	0.20	200	20˚C
14	0.25	250	25˚C
15	0.30	300	30˚C
16	0.35	350	35˚C
17	0.40	400	40˚C
18	0.45	450	45˚C
19	0.50	500	50˚C
20	0.55	550	55˚C

TABLE.2
THAWING PATH WATER TANK LEVEL MEASURED RESULT

Sl. No.	Actual Voltage	Thawing path water tank Indication
1	Below 1.5V	Low Level
2	2.5V	Medium Level
3	Above 4.5V	High Level

VI. CONCLUSION

The most main feature of any laboratory thawing path boiler controls. Several techniques can be implemented to control the boiler in hospital laboratory thawing path. The method that has to be used relies on varied objectives like better quality, greater than before efficiency, high profit, and other such points depending upon the reason of the hospital that imply it. With the major objective of catering to these necessities and the needs of the hospital zone, significance has been given here for automation.

ACKNOWLEDGMENTS

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