ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

IoT Based Boiler Temperature Monitoring and Controlling System

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Abstract

This Project provides an option for monitoring and controlling of boilers in power plant even in remote location in addition to the control room. The proposed method develops the remote monitoring and control of boiler temperature using wireless communication. This method uses Internet of Things (IoT) as the platform of communication. The proposed method also provides an option for monitoring and control even in remote location in addition to the control room. Internet of Things (IoT) will play a major role in the future concept of power plant integration. The proposed method will suit and provide a start-up initiation for this future concept. Temperature sensor sense the temperature of the boiler which is given to micro controller. Whenever the temperature value is exceeded to prescribed value it gives the alerts through Wifi, LED and buzzer.

Keywords: ***Micro controller, WIFI module, temperature sensor, DC fan, buzzer.***

1. Introduction

This Project provides an option for monitoring and controlling of boilers in power plant even in remote location in addition to the control room. The proposed method develops the remote monitoring and control of boiler temperature using wireless communication. The need for power generation in India increases day by day due to various factors. Nearly 70% of the power production is from the thermal power plants in various locations of the country. Monitoring and control of these power plants at all times is a must, since these power plants are operated continuously. This method uses Internet of Things (IoT) as the platform of communication. The proposed method also provides an option for monitoring and control even in remote location in addition to the control room. Internet of Things (IoT) will play a major role in the future concept of power plant integration. The proposed method will suit and provide a start-up initiation for this future concept.

In this project we are using temperature sensor to sense the temperature of the boiler. The 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.

Temperature sensor sense the temperature of the boiler which is given to micro controller. Whenever the temperature value is exceeded to prescribed value it gives the alerts through Wi-Fi, LED and buzzer.

2. LITERATURE SURVEY

In [1] Distributed temperature sensors (DTS) measure temperatures by means of optical fibers. Those optoelectronic devices provide a continuous profile of the temperature distribution along the cable. Initiated in the 1980s, DTS systems have undergone significant improvements in the technology and the application scenario over the last decades. The main measuring principles are based on detecting the back-scattering of light, e.g., detecting via Rayleigh, Raman, and Brillouin principles. The application domains span from traditional applications in the distributed temperature or strain sensing in the cables, to the latest "smart grid"

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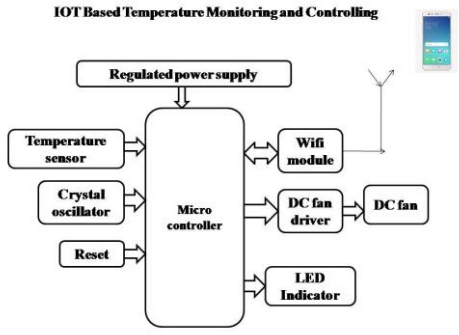
initiative in the power systems, etc. In this paper, we present comparative reviews of the different DTS technologies, different applications, standard, and upcoming, different manufacturers..

[2] Thermal modelling of large pulverized fuel utility boilers has reached a very remarkable development, through the application of CFD techniques and other advanced mathematical methods. However, due to the computational requirements, on-line monitoring and simulation tools still rely on lumped models and semiempirical approaches, which are often strongly simplified and not well connected with sound theoretical basis. This paper reviews on-line modelling techniques, aiming at the improvement of their capabilities, by means of the revision and modification of conventional lumped models and the integration of off-line CFD predictions. The paper illustrates the coherence of monitoring calculations as well as the validation of the on-line thermal simulator, starting from real operation data from a case-study unit. The outcome is that it is possible to significantly improve the accuracy of on-line calculations provided by conventional models, taking into account the singularities of large combustion systems and coupling off-line CFD predictions for selected scenarios.

3. IMPLEMENTATION:



From the above figure, we can see that the device which is able to perform the task is a **micro controlle**r. Here Temperature sensor sense the temperature of the boiler which is given to micro controller. Whenever the temperature value is exceeded to prescribed value it gives the alerts through Wi-Fi, LED and buzzer then also cooling is on

4. RELATED WORK:

This system consists of 16f876A micro controller which is the main controlling part of the system. The temperature sensor will measure the temperature of the boiler when it is crossed the set temperature shows the high alert in mobile and buzzer also then on the cooling fan with micro controller. The brief introduction of different modules used in this project is discussed below:

Micro controller (16f876A):

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 28-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F876A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 5 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

Program Memory Type - - Flash
Program Memory (KB) -- 14
CPU Speed (MIPS) -- 5
RAM Bytes --- 368
Data EEPROM (bytes) --- -256
Digital Communication Peripherals -- 1-UART, 1-SPI, 1-I2C1-MSSP(SPI/I2C)
Capture/Compare/PWM Peripherals ---- 2 Input Capture, 2 CCP,

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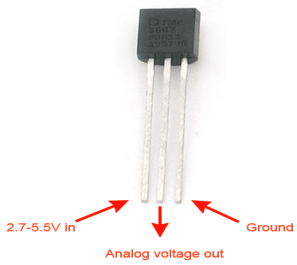
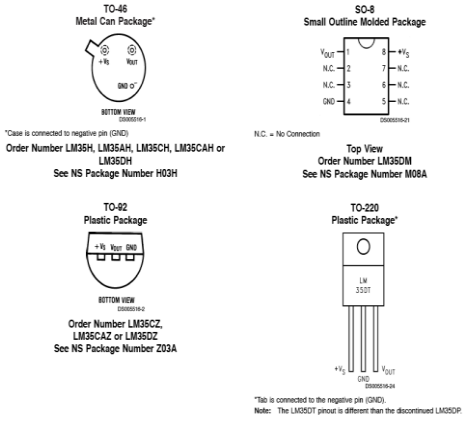
Timer -- 2 x 8-bit, 1 x 16-bit
ADC -- 5 ch, 10-bit
Comparators -- 2
Temperature Range (C) ==- 40 to 125
Operating Voltage Range (V) -- 2 to 5.5
Pin Count - 28

Temperature sensor:

The LM35 sensor series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. To detect the heat produced during fire occurrence we use temperature sensor.



The Temperature Sensor LM35 sensor series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.



The LM35 series are precision integrated-circuit LM35 temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 sensor thus has an advantage over 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. The LM35 sensor 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 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55° to +150°C temperature range, while the LM35C sensor is rated for a -40° to +110°C range (-10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D sensor is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

Buzzer:

Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.

To switch on buzzer -high 1
To switch off buzzer -low 1

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Notice (Handling) In Using Self Drive Method

1) When the piezoelectric buzzer is set to produce intermittent sounds, sound may be heard continuously even when the self drive circuit is turned ON / OFF at the "X" point shown in Fig. 9. This is because of the failure of turning off the feedback voltage.
2) Build a circuit of the piezoelectric sounder exactly as per the recommended circuit shown in the catalog. Hfe of the transistor and circuit constants are designed to ensure stable oscillation of the piezoelectric sounder.
3) Design switching which ensures direct power switching.
4) The self drive circuit is already contained in the piezoelectric buzzer. So there is no need to prepare another circuit to drive the piezoelectric buzzer.
5) Rated voltage (3.0 to 20Vdc) must be maintained. Products which can operate with voltage higher than 20Vdc are also available.

Wi-Fi:

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution!

4. ACKNOWLEDGEMENT

We would like to thank all the authors of different research papers referred during writing this paper. It was very knowledge gaining and helpful for the further research to be done in future.

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