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A Survey on Data Acquisition for Boiler Temperature Using RTOS.

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ABSTRACT

This paper presents an data logger for boiler temperature using RL-ARM RTOS. In order to monitor the boiler temperature, the system will store the physical values of boiler from sensor in the EEPROM along with RTC data's. So it can access the data from anywhere from the EEPROM using Personal Computer(PC). The system uses Real Time Operating System(RTOS) for task scheduling and interprocess communication to make the system reliable and fast working. RTOS are programs that schedule execution in suitable manner, manage system resources and provide a consistent foundation for developing application code. It can permit multitasking applications to coordinate their activities.

Keywords: RL-ARM, I2C, UART, EEPROM, RTC.

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INTRODUCTION

A Data Logger also called as data recorder is an electronic device that records data over a period of time. Increasingly they are based on a digital processor. They are generally tiny, battery-operated, portable and equipped with microprocessor, internal memory for data storage and sensor. Some data logger interface with personal computer and make software to activate the data logger and view the collected data and local interface device(keypad, LCD) and can be used as a stand-alone device.

Data logger changes in general purpose types for a range of measurement to very specific devices for measuring in environment. It is used for general purpose types to be programmable whereas static machines have only a limited number and no changeable parameters. Electronic data loggers is used instead of chart recorders in many applications.

SYSTEM DESCRIPTION

OPERATION OF BOILER TEMPERATURE:

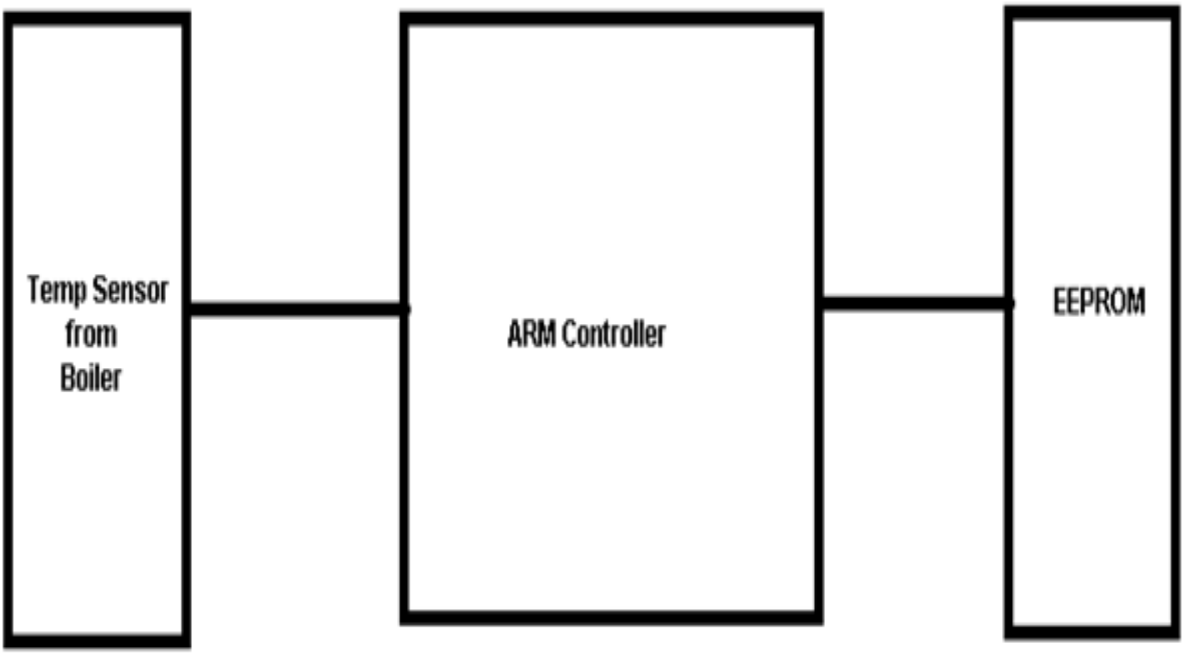

Fig (1): Block diagram of boiler temperature

The operation of a boiler is is critical to ensure safe operation and equipment to improve the efficiency. The temperature sensor is attached with boiler that is connected to ARM7 controller to make required process and then system will store physical values of temperature in EEPROM with respect to Real Time Clock(RTC)'s data. Process control, performance diagnostics and condition monitor are key technologies used to decrease or mitigate uncertainties.

The proper instrumentation initialize and control system are required to assist the operation personnel in performing dynamic and consistent operation. The system is connected with computer and make active the logger. Thereafter logger can be disconnected and implement in any system that can be viewed the records which stores the data in memory along with date and time. The measuring of boiler temperature is very essential apart from the collateral damage and by use of RTOS multitasking can be performed in efficient manner with simple operation.

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BLOCK DIAGRAM OF ARM7 LPC2148:

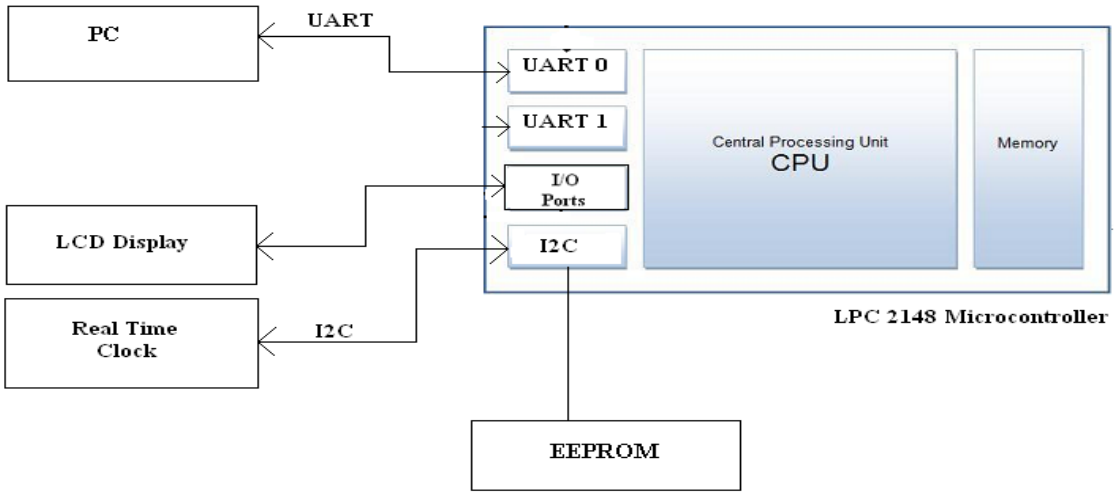

Fig (2): LPC2148 MICROCONTROLLER

The proper instrument, control logic and control system are required for the operation personnel in performing safe, efficient, and reliable operation. Inter Integrated Circuit (I2C) has been used to access the EEPROM. UART protocol has been used to communicate with Personal computer where it can read the back the data's stored in the EEPROM with higher baud rate. LCD GUI is used for instant display of RTC time and sensor data's.

RL-ARM Overview:

The Keil Real-Time Library is collection of middle-ware component are design to work across many different micro-controllers.

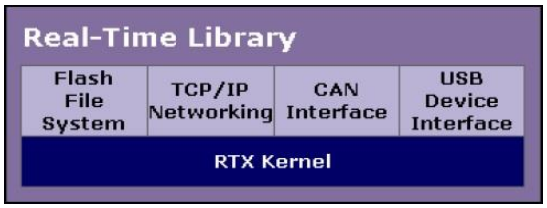

Fig (3): RL-ARM components

The Real-Time Library consists of five main components. They are Flash based file system, a TCP/IP networking suite, driver for USB and CAN, and the RTX Kernel. Each of the middle-ware components is designed to be used with the Keil RTX real-time operating system. However the exception of the CAN driver have each component may be used without RTX.

RTX Real-Time Operating System:

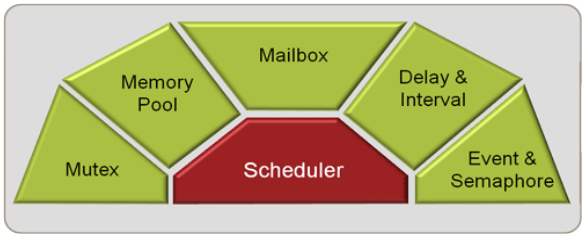

Fig (4): RTX Structure

The Keil RTX is supremacy, deterministic Real-Time Operating System design for ARM and Cortex-M devices. It support to create program that simultaneously perform multiple functions and helps to create applications which are better structure and more comfortably maintained.

METHODOLOGY

There are different methods to discriminate the boiler temperature. Some of the methods are like NFGPC, DTS, IDNC, DMC, fuzzy and coupling techniques, etc. These features are more usable for detecting the difficulties of measuring the temperature.

Neuro-Fuzzy Generalized Predictive Control of Boiler Temperature:

X.J. Liu and C. W. Chan (2006), in their paper have reliable control of steam temperature is essential to ensure high efficiency and high load capability in operation of power plant. This is often difficult to achieve using PI controllers since power plants are nonlinear and contain many uncertainties. A nonlinear GPC based on Neuro-fuzzy(NFGPC) is proposed in this paper which consists of Generalised predictive controllers design using local linear models of the neuro-fuzzy network that models the plant. The nonlinear controller is applied to control superheated steam temperature of a 200 MW power plant. The simulation of the plant have better performance than cascade PI controller or linear GPC is obtained.

SVD based automated dike monitoring system:

Amir A. Khan (2008), in their paper uses Singular Value Decomposition. The detection of water leakages in dikes using distributed temperature sensors is exciting prospect due to the commercial viability of these optical fiber based sensors. The Distributed Temperature Sensors (DTS) depends upon optical fibers were effectively used for the acquisition of temperature data. These sensors provide temperature readings over long distances with high spatial and temperature resolutions. It has ability to intialize a large number of passive optic sensor within a single low cost telecommunications grade optical fibers cable frequently enhance their commercial viability.

Superheater Steam using IDNC:

Yongjun Lin and Kwang Y. Lee (2010), in their paper uses Inverse Dynamic Neuro-Controller (IDNC) is developed for super-heater steam temperature control of a boiler unit. A recurrent neural network was used for constructing the Inverse Dynamic Process model(IDPM) for the super-heater system. Two inverse dynamic neural network (NN) refers to the first stage and the second water-spray attemperator are constructed. To achieve highly accurate approximation of the super-heater system, the neural network model are constructed with sufficient historical data in a wide operating range, which has both different steady state conditions and dynamic transients. Then the Inverse Dynamic Neuro-Controller(IDNC) are designed based on the well-trained Inverse Dynamic Process Model(IDPM) and applied to super-heater steam temperature control. In order to eliminate the steady state control error arised by model error, a simple feedback proportional-integral-derivative controller compensator is added to an inverse controller. Control tests are carried out on initiative simulator for a 300 MW coal-fired power generating unit. It show that the temperature control is greatly improved with the Inverse Dynamic Neuro-Controller (IDNC) compared to the original cascaded PID control scheme.

Boiler Steam Temperature Control Using DMC:

Woohun Kim (2010), in their paper uses Dynamic Matrix Control for controlling steam temperatures in a large scale through boiler turbine system. In order to control steam temperatures, they chooses spray and damper as two controllers. The step response model for the Dynamic Matrix Control is generated for the two major output variables, super-heater and re-heater temperature, by performing step-input tests. On-line optimization is performed for the Dynamic Matrix Control using the step response model. Proposed controller is implemented in large scale power plant simulator and the simulation results in satisfactory performance of the proposed Dynamic Matrix Control technique.

Design of the boiler temperature and controlling system using fuzzy and coupling system:

Zheng Lijun (2011), in this paper it measure and controlling objects, such as boiler temperature and its correlative flow. In thermal power plant, it has automatic measure and controlling system for boiler process variable is set up by using fuzzy and coupling technique. The system can meet requirements of generating power, generating heat and steam from the boiler, this improving the better performance for measurement and control the boiler temperature, liquid level and pressure. Since configurations of both hardware and software are uncomplicated and the operation is easier, this system is also applicable to any similar thermal power plant.

CONCLUSION

The Survey paper proposed various methodologies to measure the boiler temperature. So the proposed system was design by latest microcontroller ARM 7 LPC 2148 for fastest processing and reliable system design using RTOS. Therefore the boiler temperature can be measured efficiently and it can store the temperature values in the EEPROM with RTC's data to ensure the safe operation and to improve its efficiency.

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