AVR Microcontroller Based Temperature Control System with Real Time Data Logger

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Abstract: The Purpose of this system is to develop AVR Microcontroller Based Temperature Control System with Real Time Data Logger. The temperature monitoring and controlling is becoming more crucial issue in today's word it also having a more importance in a various industry & various processing plants. Proposed system consists of design and construction of an AVR microcontroller-based automated Temperature control system & Data logging. A data logger keeps the record of temperature measurements over a period of time. Data loggers are provided with real time clocks where data is sequentially stored in memory. The proposed system maintains temperature within predefined range; also it generates controlling action when necessary in terms of heater and fan. The heater is set in between range of 58^0 C to 62^0C temperature. The designed system is tested under different conditions: at room temperatures, low temperatures, conditions as well as in different temperatures conditions. Proposed system provides better performance. The proposed systems have low cost, versatile, portable. This system helpful in small as well as large scale industries where temperature controlling is an essential task

Keywords: AVR microcontroller, data logger, real time clock, heater, fan, monitoring and controlling.

I. INTRODUCTION

The objective of this system is to create an Automatic Temperature Control and data logger system. The circuit maintains the temperature of the system in a particular range. The design is associated with flexible structure for the software and the hardware support. The proposed system consist of Temperature Sensor, AVR controller, LCD Module, keypad, Heater, Printer. The Temperature Sensor detects the temperature; the temperature sensor is connected to the ADC of the AVR controller. The AVR controller is connected to a switching device relay through driver circuit. It is used to switch on the heater or fan. The LCD module displays the current temperature of the system where data logger maintains all the data of the measurements

The aim of this work is to use data logging for temperature measurement. The temperature sensor acquires the temperature of the system. In the proposed system we use the temperature sensor LM35. The analog output of temperature which is analog form that converted into digital form with ADC. Driver circuit connected to the AVR through driver circuit. It is used to generate controlling action. The speed of the fan is controlled by the ON time & OFF time of the relay by the controller.

The AVR controller based temperature data logger has been developed for measuring temperature range. The device is designed to receive data from temperature sensors and to store the results on external non-volatile electrically erasable programmable read only memory for post process analysis. An integrated Liquid crystal display (LCD) is also used for real time display of data acquired from various sensors.

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II. SYSTEM ARCHITECTURE AND WORKING PRINCIPLE

The proposed architecture of AVR microcontroller based temperature control system with real time data logger are divided into two parts

    A.   Hardware Part &

    B.   Software Part

The temperature monitoring is becoming more and more important in a lot of industries, like food industry, the laboratory, and pharmaceutical industry.

The concept of this project is to develop an Automatic Temperature Control system and data logger. The proposed system maintains the temperature of the system within specified range. In the circuit, it consists of Temperature Sensor, AVR controller, LCD Module, keypad, Heater &Printer. The Temperature Sensor detects the temperature. The temperature sensor is connected to the ADC of the AVR controller. The AVR controller is connected to a switching device relay through driver circuit. It is used to switch on the heater. The LCD module displays the current temperature of the system. The design is associated with flexible structure for the hardware support & software support. The AVR controller based temperature data logger has been developed for measuring temperature at different input channels of ADC. The device is designed to receive data from temperature sensors and to store the results on external non-volatile electrically erasable programmable read only memory for post process analysis. An integrated Liquid crystal display (LCD) is also used for real time display of data acquired from various sensors. The design is associated with flexible structure for the hardware support.
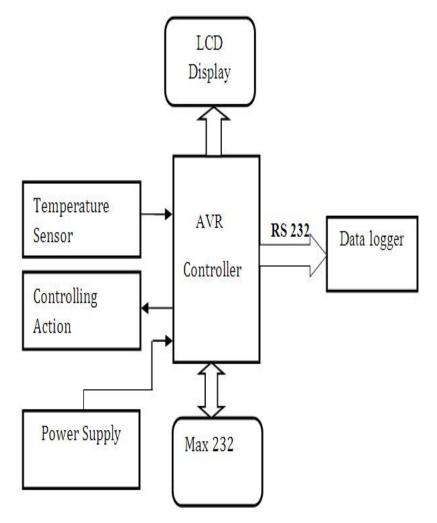

Fig. 1 Block Diagram Temperature Control System System

III. SYSTEM SOFTWARE REALIZATION

Fig. 2 hardware representation of system with proteus software

Here we are use LM35 temperature sensor which senses the temperature. In this project we can use the AVR microcontroller for controlling purpose, the output of the sensor is connected to the Analog Channel 0 of the controller. At the power on first controller initialize the all ports, uart and Lcd, then controller reads the key status if key is pressed then appropriate message display on screen and perform its operation. The controller gets the set points from the keypad. After this it will start the reading the data from the sensor. Then this data is compare to their set points, if data is greater than set point then the relay will be off otherwise relay is on. Also this data is send to the computer for logging purpose. After this is serially connected to the com port of the computer & it stores the temperature readings. BY using the AVR studio & visual studio we will display the temperature on the computer screen. .After every hour we get the print outs of the temperature& also after every 100 hours it gives print automatically.

IV. FLOWCHART OF SYSTEM

```
START
  │
  ▼
Initialisizing LCD & ADC of the MC
  │
  ▼
Get High temp limit from Keypad
  │
  ▼
If ok switch is pressed ──No──┐
  │ Yes                        │
  ▼                            │
Get Low temp limit from Keypad │
  │                            │
  ▼                            │
If ok switch is pressed ──No──┤
  │ Yes                        │
  ▼                            │
Get the value from sensor      │
  │                            │
  ▼                            │
Calibrate & display on LCD &   │
serial port                    │
  │                            │
  ▼                            │
Compair this value to setting High & Low
  │
  ▼
  A

A
  │
  ▼
If temp < low limit ──No──┐
  │ Yes                    │
  ▼                        │
Heater is ON               │
  │                        │
  ▼                        │
If temp > High limit ──No──(to Compair loop)
  │ Yes
  ▼
Heater is Off
```

Visual Studio

The graphical user interface describes anything your application displays to the user. It is the primary way you interact with the user and allow him or her to interact with you. we can create professional interfaces with minimal effort. Graphical User Interfaces have been around for many years. Visual C++ 2008 provides a powerful and flexible development environment for creating Microsoft Windows–based and Microsoft .NET–based applications. Here we use Visual C++ 2008 in an integrated development system.
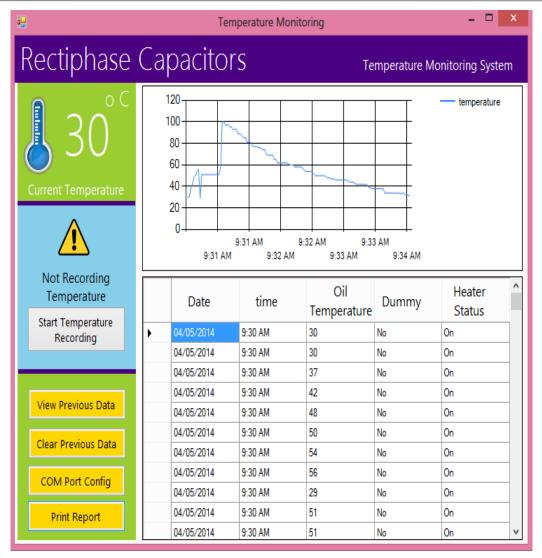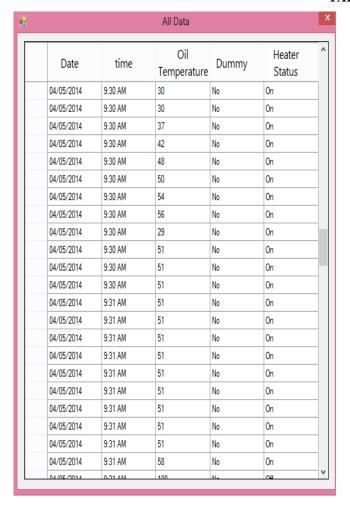
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Fig. 3 Temperature control system with real time data logger storage system

V. RESULTS AND ANALYSIS

After initializing the system, LCD & ADC of the AVR microcontroller are turned on. After initializing set the High limit via keypad then ok switch is pressed if high temperature limit is not set then it will back to the loop, similarly set the low temperature limit via keypad. If temperature is greater than High limit then Heater is off. If temperature is less than low limit then Heater is on, then after getting the temperature value from sensor to the system it is directly calibrated & display on the LCD through serial port. Compare this value displayed on LCD with low and high temperature value. The readings are taken under different conditions for some time interval. Also the readings are taken at different temperatures in a time interval. After we get readings of the temperature using the AVR studio & Visual studio. Finally we get the print outs of the 100 hour of the temperature.
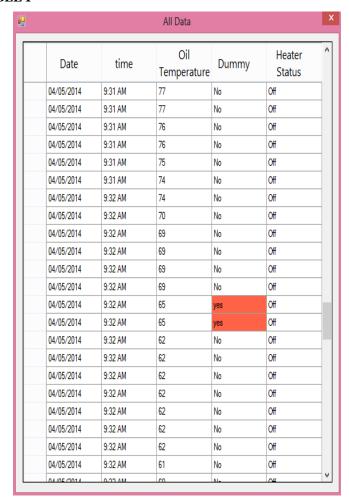
TABLE I

Date	time	Oil Temperature	Dummy	Heater Status
04/05/2014	9:30 AM	30	No	On
04/05/2014	9:30 AM	30	No	On
04/05/2014	9:30 AM	37	No	On
04/05/2014	9:30 AM	42	No	On
04/05/2014	9:30 AM	48	No	On
04/05/2014	9:30 AM	50	No	On
04/05/2014	9:30 AM	54	No	On
04/05/2014	9:30 AM	56	No	On
04/05/2014	9:30 AM	29	No	On
04/05/2014	9:30 AM	51	No	On
04/05/2014	9:30 AM	51	No	On
04/05/2014	9:30 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	51	No	On
04/05/2014	9:31 AM	58	No	On
04/05/2014	9:31 AM	100	No	Off

Date	time	Oil Temperature	Dummy	Heater Status
04/05/2014	9:31 AM	77	No	Off
04/05/2014	9:31 AM	77	No	Off
04/05/2014	9:31 AM	76	No	Off
04/05/2014	9:31 AM	76	No	Off
04/05/2014	9:31 AM	75	No	Off
04/05/2014	9:31 AM	74	No	Off
04/05/2014	9:32 AM	74	No	Off
04/05/2014	9:32 AM	70	No	Off
04/05/2014	9:32 AM	69	No	Off
04/05/2014	9:32 AM	69	No	Off
04/05/2014	9:32 AM	69	No	Off
04/05/2014	9:32 AM	69	No	Off
04/05/2014	9:32 AM	65	yes	Off
04/05/2014	9:32 AM	65	yes	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	62	No	Off
04/05/2014	9:32 AM	61	No	Off
04/05/2014	9:32 AM	60	No	Off

Table I. Shows real time temperature control readings with heater actions

VI. CONCLUSION

In this system AVR Microcontroller Based Temperature Control System with Real Time Data Logger is designed and developed. With the help of data logger we can maintain all records of the temperature monitoring and controlling. Data is logging & the data is transmitted to computer by serial port. Output is displayed on LCD display& also heater status is displayed on lcd. This system also implemented for temperature monitoring in the laboratory and pharmaceutical industry. A lot of storage and testing environments, including fridges and freezers and even the lab.

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