COMPUTER ORGANISATION AND ARCHITECTURE

**TOPIC:**

Temperature Control system using 8086.

**AIM:**

**To develop Temperature Control system using 8086**

**APPARATUS:**

**Microprocessor trainer kit, Temperature controller kit, power supply, data cable etc**

**THEORY:**

**Temperature control system involved interfacing successive approximation ADC and typical method of measuring and controlling the temperature using microprocessor. ADC is among the most widely used devices for data acquisition. A digital computer uses binary values, but in physical world everything is analog, temperature, pressure, humidity, and velocity are few examples of physical quantities that we seal with every day.**

**Temperature measurement is of great importance in industry as most of the processes are temperature dependent. A number of devices and schemes have been used over the years, for the measurement of temperature. Typical sensors include devices like thermocouples, thermostats, RTD’s and semiconductor sensor.**

**This system uses semiconductor sensor AD590 to monitor the temperature of water bath. The AD590 is basically a PTAT (proportional to absolute temperature) current regulator. It generates a current O/P of 1µA/K above absolute zero temperature that is -2730C. Thus at 00C the current O/P will be 273µA and 250if will be 298µA and 373mV at 1000. This O/p is buffered through an OPAMP having a gain of 10. To enable easy equivalence between the transducers O/P in volts and the measured temperature a calibration procedure needs to be done.**

**WORKING:**

**8255 is interfaced with 8086 in I/O mapped I/O. port A (PA0-PA7) as input port is connect to data lines of ADC, PB0, PB1, PB2 lines of port B for channel selection, PC2 connected to Start of conversion (SOC) and PC3 to O/P enable. Channel 1 of ADC is used to input analog signal, Channel 0 of ADC for temperature controller.**

**ADC will give binary equivalent of the I/P voltage. Input will vary from 0 to 5V (0 to 100 degree C) and the ADC O/P varies from 00-FFH. So 5V/100 i.e.**

**5000mvs/100 gives 50mvs/0C. And the counts for indication of temperature are taken as 2.5 (256/100) per degree C.**

**AC supply to the external heating element is controlled through the onboard Relay, based on the set value. When the temperature of the heating element (which is sensed by AD590, AD590 output is analog which is converted to digital by ADC) is less than the set value (reference value) heating element will be switched ON and when temperature crosses the set temperature AC supply is turned OFF.**

**ASSEMBLY LANGUAGE CODE:**

MODEL SMALL

.STACK 100

.DATA

START:

PORTA EQU FFC0H ; PORTA address

PORTB EQU FFC2H ; PORTB address

PORTC EQU FFC4H ; PORTC address

CTL EQU FFC6H ; Control port address

CTL\_BYTE EQU 98H ; 8255 control reg.

CLEAR\_DISPLAY EQU F800:4BB1H

DWAD EQU F800:4BB1H

DBDTA EQU F800:4F1F

DEC\_TEMP DB 0

SET\_TEMP DB 0

ADC\_VAL DB 0

COUNT DB 0

PRE\_TEMP DB 0

.CODE

ADC TABLE:

DB 00H,03H,05H,08H,0aH,0dH,0fH,11H,14H,16H

DB 19H,1cH,1eH,21H,24H,27H,2aH,2cH,2eH,32H

DB 34H,36H,39H,3cH,3fH,42H,45H,48H,4aH,4cH

DB 4eH,50H,52H,54H,56H,58H,5bH,61H,64H,67H

DB 6aH,6dH,70H,72H,74H,77H,7aH,7dH,7fH,82H

DB a0H,a2H,a5H,a8H,aaH,aDH,afH,b0H,b3H,b6H

DB b9H,bcH,bfH,c1H,c4H,c6H,c9H,ccH,cfH,d0H

DB d2H,d5H,d7H,daH,dcH,dfH,e0H,e2H,e5H,e7H

DB e9H,ebH,eeH,f1H,f4H,f6H,f9H,fcH,ffH

START:

MOV AL,CTL\_BYTE ; 8255

MOV DX,CTL ; PORTC (lower) as output OUT DX,AL ; PORTA as input

MOV AL,DEC\_TEMP

CALL DEC\_HEX

MOV SET\_TEMP,AL

MOV AL,DEC\_TEMP

MOV AH,00

MOV SI,AX

CALL FAR DWAD

MOV DX,CTL eeb

MOV AL,02

OUT DX,AL

MOV AL,00

OUT DX,AL

MOV CX,70

L0:

LOOP L0

BACK:

MOV COUNT,0

CALL ADC

CALL DISP\_TEMP

CALL TEMP\_CONTL

JMP BACK

DISP\_TEMP:

MOV AL,ADC\_VAL

MOV SI,OFFSET ADC\_TABLE

AGAIN:

CMP AL,[SI]

JC FOUND

JE FOUND

INC SI

INC COUNT

JMP AGAIN

FOUND:

MOV AL,COUNT

CALL HEX\_DEC

MOV AH,0

MOV SI,AX

CALL FAR DBDTA

RET

TEMP\_CONTL:

MOV AL,COUNT

CMP AL,SET\_TEMP

JC TURN\_ON\_RELAY

RELAY\_OFF:

MOV DX,PORTB

MOV AL,0FFH

OUT DX,AL

MOV DL,20H

HERE1:

MOV CX,FFFFH

HERE:

LOOP HERE

DEC DL

JNZ HERE1

RET

TURN\_ON\_RELAY:

MOV DX,PORTB

MOV AL,00H

OUT DX,AL

CONTINUE:

MOV CX,FFFFH

L22:

LOOP L22

RET

ADC:

MOV DX,CTL

MOV AL,01

OUT DX,AL

MOV CX,70

L10:

LOOP L10

MOV AL,00

OUT DX,AL

L1:

MOV DX,PORTC

IN AL,DX

AND AL,80H

CMP AL,80H

JNZ L1

MOV DX,PORTA

IN AL,DX

MOV ADC\_VAL,AL

RET

HEX\_DEC:

MOV AH,00H

MOV CL,0AH

DIV CL

MOV CL,04H

ROL AL,CL

AND AL,F0H

OR AL,AH

RET

DEC\_HEX:

MOV BL,AL

AND BL,0FH

AND AL,F0H

MOV CL,04

ROR AL,CL

MOV CL,0AH

MUL CL

ADD AL,BL

RET

END START

**PROCEDURE:**

**1. Connect power supply 5V & GND to both microprocessor trainer kit & temperature controller interfacing kit.**

**2. Connect data bus between microprocessor trainer kit & temperature controller interfacing kit.**

**3. Enter the program to read temperature of the water bath from ADC at 0000:4000.**

**4. Execute the program by typing GO 0000:4000 enter.**

**5. Enter the reference temperature value, when temperature of water bath exceeds reference value then power supply to water bath is switched OFF.**