



# ROOM TEMPERATURE SENSOR

Submitted by: Group 0

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## User Requirements & Technical Specifications

Design a System that senses the temperature in a room and displays them on 2, 7-segment displays.

The Technical Specifications are as follows

- Size of the room is as large as the BITS Auditorium only one floor
- Temperature range is from 15°C to 35°C
- Resolution required is 1°C
- Temperature has to be sensed every 2 minutes and the display should be updated

## Assumptions & Justifications

### Justification

1. Based on the size of the room only 6 sensors required. There are 3 wings and there are two zones per wing.
2. As the value to be displayed is only between 15°C to 35°C and resolution is only 1°C there is only a need for two seven segment displays.

### Assumptions

None Made.

## Components used with justification wherever required

- 8086
- 8284
- Temperature Sensor (Manual Attached) – 6 Nos.

ATS2000A – This covers the required temperature range with required resolution

Temperature range 32 F – 150 F

Voltage i/p 5-30V – DC Regulated with a typical Voltage -12 V DC 1.5 mA

Four –pin connector – V<sub>CC</sub>, GND, T20 and T10

PIN	SIGNAL	Input/ Output	Scale Factor	Description
1	+V	INPUT	N/A	Voltage referenced to the COM terminal (+5Vdc min to +30Vdc max )
2	T10	OUTPUT	10.0mV/°F	Temperature Signal (direct reading)
3	T20	OUTPUT	19.6mV/°F	Temperature Signal (scaled for 8-bit ADC)
4	COM	INPUT	N/A	Common (power supply & ADC common

- ADC 0808 – 6 analog inputs with voltage varying from 0 – 5 V with 8-bit resolution T 20 output can be directly connected to it (as it directly compatible) – Manual Attached
- Common Anode Seven Segment Display – 2 Nos. As 2 digits are to be displayed
- 7447 – BCD to Common Anode 7 – Segment converter -as values will be only numeric values
- 8255 – Interface ADC and 7447
- 8254 – to generate ADC Clock and 2 Minute RTI – to read the temperature
- 8259 – Interrupts from EOC from ADC and Timer Interrupt every 2 Minute. Timer given higher priority as the timer is the one that enables the ADC for conversion
- 2716 – 4 nos. Smallest ROM chip available is 2K and as we need to have even and odd bank and ROM is required at reset address which is at FFFF0<sub>H</sub> and 00000<sub>H</sub> - where there is the IVT
- 6116 – 2 nos. Smallest RAM chip available is 2 K and we need odd and even bank. We need RAM for stack and temporary storage of data
- LS 138 – 2 decoders
- LS 373, LS 245, LS 244 and required gates

## Address Map

### Memory Map

ROM1 – 00000<sub>H</sub> – 00FFF<sub>H</sub>

RAM 1– 01000<sub>H</sub> – 01FFF<sub>H</sub>

ROM2 – FF000<sub>H</sub> – FFFFF<sub>H</sub>

### I/O Map

8255 – 00 – 06<sub>H</sub>

8254 – 08 – 0E<sub>H</sub>

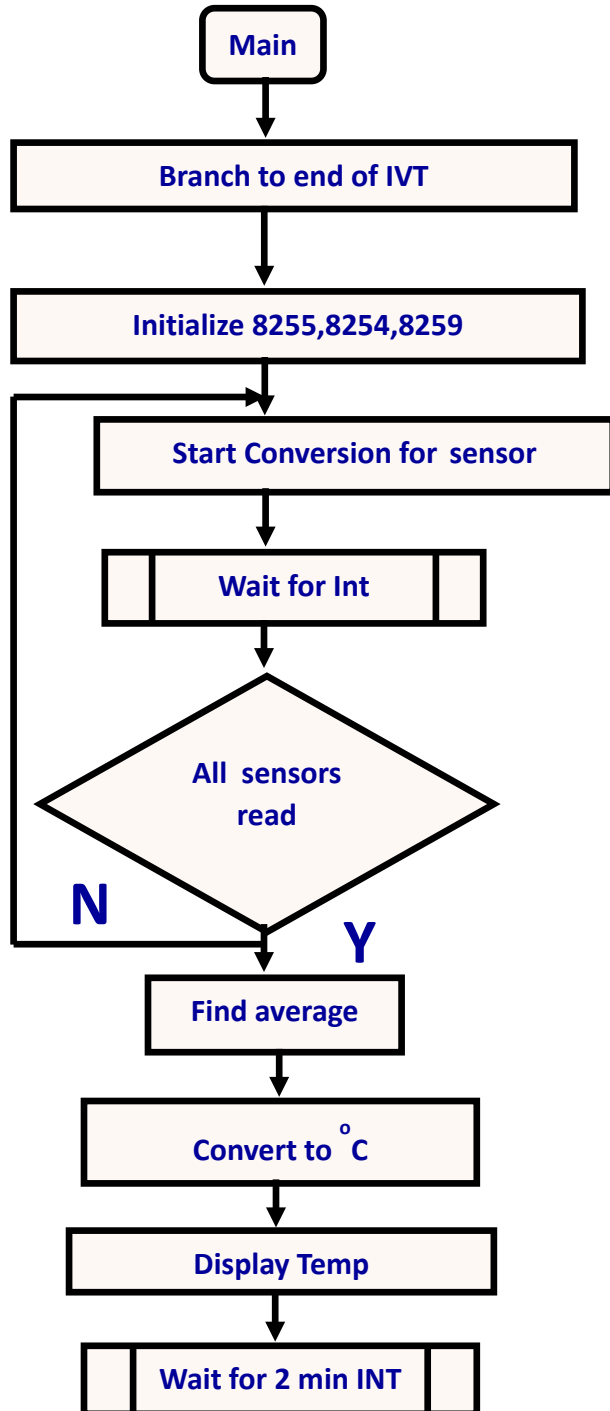
8259 – 10 – 12<sub>H</sub>

## Design

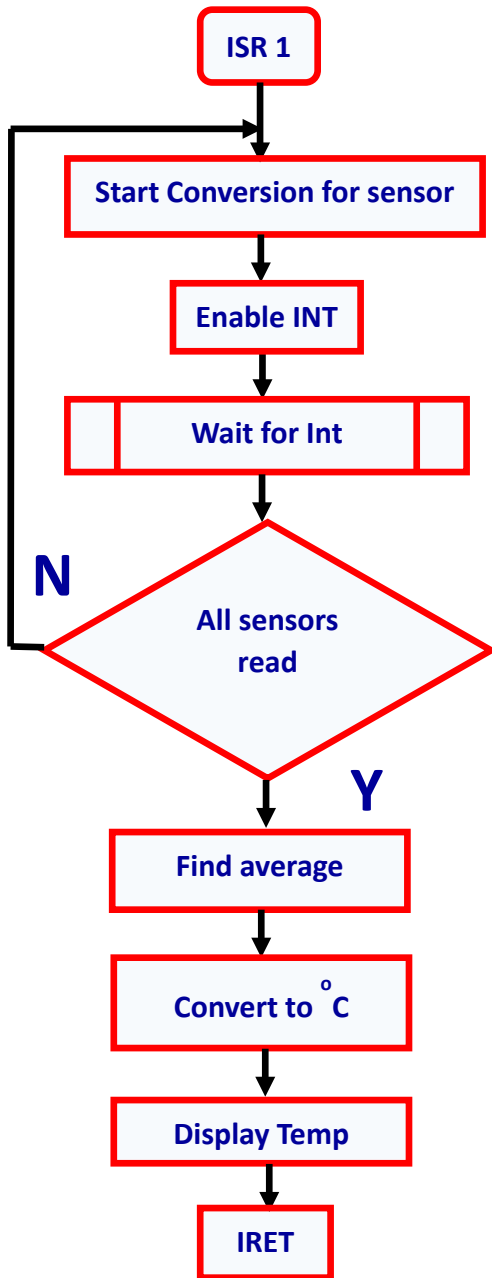
Complete design shown with proper labelling (design attached)

## Flow Chart

### Main Program

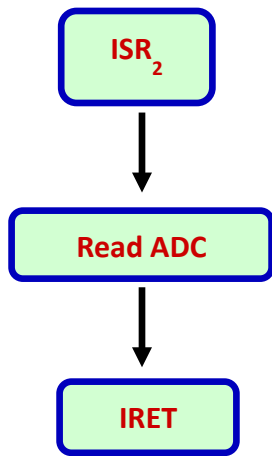


Flow Chart of ISR





ADC ISR



## Variations in Proteus Implementation with Justification

1. Using 2 Min delay as 8259 does not work in proteus – EOC is used as NMI and the Timer Int replaced by software delay as 2 Minutes
2. ROM in only 00000 – as proteus allows to change reset address.
3. Using 8253 – as 8254 not available in Proteus.
4. Clock is at 2 MHz as the clock generated for 8086 requires a long rise and fall time of clock. So ADC clock will be only 500KHz that is also ok as 1 MHz is the max clock that can be provided.
5. 2732 is used as 2716 – not available in Proteus.
6. Using a gate-based circuit for memory – does the same as LS 138 here
7. Temperature Sensor – replaced by DC voltage source giving voltage between 0 – 5 V – as all sensors not there in Proteus
8. 8259 not there – justification is as per point 1.

## Firmware

Implemented using emu8086 attached.

## List of Attachments

1. Complete Hardware Real World Design – example.pdf
2. Manuals
  - a. ADC 0808
  - b. ATS 2000A
3. Proteus File – adc.dsn
4. EMU8086 ASM File – adc.asm
5. Binary File after assembly – adc.bin