Weather Monitoring System
Design Specifications

- A Weather monitoring System has the following sensors.
- The weather has to be monitored regularly at intervals of 5 minutes and data sent serially using null modem interface to a remote PC.
Design Specifications

- WE570 Wind Direction Sensor- Type Wind vane with potentiometer
- Output 4-20 mA
- Range 0 to 360°
- Sensitivity 1 m/s (2.2 mph)
- Accuracy 1% full scale
- Operating Voltage 10 to 36 VDC
- Warm-up Time 3 seconds minimum
- Operating Temperature: -40° to +55°C
Design Specifications

- Wind Speed Sensor
- Specifications- Output: 4-20mA
- Range: 0-100 MPH
- Accuracy: .5 MPH over the range 11 to 55 MPH
- Operating Voltage: 10-36VDC
- Warm Up Time: 3 seconds minimum
- Operating Temp: -40° to +55°C
Design Specifications

- Solar Radiation Sensor:
  - Output: 4-20mA
  - Range: 0-1500 W m²
  - Accuracy: 1% of full scale
  - Operating Voltage: 10-36VDC
  - Warm Up Time: 3 seconds minimum
  - Operating Temperature: -40°C to +55°C.
Design Specifications

- Humidity Sensor
- Output: 4-20mA
- Range: 0-100% RH
- Accuracy: + 2% RH
- Operating Voltage: 10-36VDC
- Current Draw: 3 mA plus sensor
- Warm Up Time: 3 seconds minimum
- Operating Temp: -40° to +55°C
Design Specifications

- Temperature Sensor
- Output: 4-20mA
- Range: -50°C to +50°C
- Accuracy: ±2°F or ±1°C
- Operating Voltage: 10-36VDC
- Warm Up Time: 5 seconds minimum
- Operating Temperature: -50°C to +100°C
Design Specifications

- Barometric Pressure Sensor
- Output: 4-20mA
- Range: 800-1100 millibars
- Accuracy: +1% of full scale
- Operating Voltage: 10-36VDC
- Warm Up Time: 3 seconds minimum
- Operating Temp: -40° to +55°C
Step 1 : How to interface Sensor to system

- No of analog i/ps-6
- 8-channel ADC
- Size of ADC
  - Resolution of sensor
    - 19.6mv
- 8-bit
- 0808 – 8 channel, 8-bit ADC
ADC 0808

CLK
DB0 – DB7
AD0
AD1
AD2
EOC
OE
SOC
ALE
IN0
IN1
IN2
IN3
IN4
IN5
IN6
IN7

Analog I/ps

5V
0V
Vcc
GND

Supply

\[
\frac{5 \text{ V}}{255} = 19.6078 \text{ mV}
\]
Step 2: How to interface ADC to 8086?

- 2 ports available use it for ADC
ADC 0808

1 MHz

PB₀ – PB₇

PC₀
PC₁
PC₂

INTR

PC₃
PC₄
PC₅

AD₀
AD₁
AD₂

EOC
OE
SOC

IN₀
IN₁
IN₂
IN₃
IN₄
IN₅
IN₆
IN₇

V_REF+
V_REF-
Vcc
GND

Supply

5V
0V

sensors
Generate 1 MHz

- Use 8254
- Any other timing
- Read every 5 Minutes
STEP 3 : 1 MHz clock & 5 MIN Interrupt

- Use 8254
CLK_0 → OUT_0
GATE_0 → mode_3

CLK_1 → OUT_1
GATE_1 → mode_2

CLK_2 → OUT_2
GATE_2 → mode_2

1 MHz ADC CLK
Count = 5_d

5 MHz

5 minutes
Count = 30000_d

5V

100 Hz

1 MHz
Count = 50000_d

5V

5V

5V

5V

5V

5V

5V

5V

5V

5V

5V

5V
STEP 4: Interrupt Generation

- Use 8259
8259

INT
INTA
CAS₀
CAS₁
CAS₂
SP/EN

IR₀
IR₁

Timer
ADC

5V
Step 5: Output Interface

- Serial Port Null Modem

- RTS
- CTS
- RXD
- TXD

- 16550

- DTR
- DSR
- DCD
STEP 6: How to interface 8255, 8254 & 8259, 16550

- Memory mapped/ IO mapped?
- Fixed/ Variable addressing?
- Address
- 80 - 86H - 8255
- 90H - 96H - 8254
- A0H - A2H - 8259
- B0H - BEH - 16550
- Incremental Addressing
STEP 7: HOW to Interface Memory

- How much memory?
- ROM/RAM?
- RAM – minimum 2k chip - 4k
- ROM – minimum 2k chip – 4k + 4k
- ROM1 \(00000_{H}\)
- ROM2 \(FF000_{H}\)
- RAM \(01000_{H}\)
Interface to the processor

8255

A_1 → A_0
A_2 → A_1

CS

RD
WR

D_0 – D_7

RESET

from 8284

RESET

8255
System Bus of 8086 (Address)
System Bus of 8086 (Data + Control)
<table>
<thead>
<tr>
<th>M/IO'</th>
<th>RD'</th>
<th>WR'</th>
<th>Bus cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>MEMR'</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>MEMW'</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>IOR'</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>IOW'</td>
</tr>
</tbody>
</table>
15 MHz

8284

5 V

VCC

MN/MX

RESET

CLK

READY

NMI

HOLD

GND

8086 Inputs
Step 8: Software

**Main**

- Branch to end of IVT

**Initialize 8255, 8254, 8259**

**Start Conversion for sensor**

- **Wait for Int**

All sensors read:
- **Y**
  - **ISR₁**
    - SOC (S1-S6)
    - IRET

- **N**
  - **ISR₂**
    - Read ADC
    - IRET

16550 send data
- **Wait for 5 min INT**

**B**
Step 8: Software - ISR

ISR 1

Start Conversion for sensor

Enable INT

Wait for Int

N

All sensors read

Y

Send via 16550

IRET

ISR₂

Read ADC

IRET
Initializing 8255

i8255:  mov  al,10000010b
     out  86H , al
Initializing 8254

i8254:  mov  al,00110110b
         out  8E_H , al
         mov  al,01110101b
         out  8E_H , al
         mov  al,10110101b
         out  8E_H , al
Initializing 8254

mov al,5
out 88H , al
mov al,0
out 88H , al
mov al,50h
out 8AH , al
mov al,0C3h
out 8AH , al
mov al,30h
out 8CH , al
mov al,75h
out 8CH , al
Initialising 8259

I8259:  mov  al,1111 1100b
        out  90h,al
        mov  al,1000 0000b
        out  92h,al
        mov  al,0000 0011b
        out  92h,al
        mov  al,1111 1100b
        out  92h,al
16550 Initialization

- 9600 baud
- 8 data
- Odd parity
- 1 stop
- SA – F0H
16550 initialization

LINE EQU 0A6H
LSB EQU 0A0H
MSB EQU 0A2H
FIFO EQU 0A4H
INIT:
  MOV AL,10001011B
  OUT LINE,AL
  MOV AL,120
  OUT LSB,AL
  MOV AL,0
  OUT MSB,AL
  MOV AL,00001011B
  OUT LINE,AL