BITS Pilani
K K Birla Goa Campus

# Microprocessor and Interfacing

Project Question No - 25
Batch Number - 80

# Weather Monitoring System

By:

Omkar Kulkarni - 2014A7PS034G
Kartik Kenny - 2014A7PS078G
Advait Koparkar - 2014A3PS170G
Devgeet Patel - 2014A3PS221G

# Problem Statement

System Description

This system monitors weather parameters such as: Air Temperature, Air-Humidity, barometric Pressure, and Displays the average over regular intervals of an hour on a seven-segment display. The Display is continuous. Update of the display is done once in an hour. Weather parameters are sensed at regular intervals of 5 minutes.

Other than the regular display, the user can request the display of the weather parameters to be updated at any point of time by pressing a push button key. The accuracy of the parameters monitored has to be up to two decimal points.

# Design Specifications

- Parameters Measured:
  - Temperature
  - Pressure
  - Relative Humidity

- Parameters sensed every five minutes
- Average updated every one hour
- Push Button key to update average at anytime before one hour interval

# Assumptions

- Assume there is an uninterrupted power supply.
- The .asm file is compiled and the executable file is stored permanently in the ROM.
- In displaying the parameters we have made use of persistence of vision.
- We are using a frequency in the order of MHz.

# Components - Overview

- WE 700 - Temperature Sensor
- WE 100 - Barometric Pressure Sensor
- WE 600 - Relative Humidity Sensor
- 8086
- 8255 (2)
- 8254 (1)
- 8259
- ROM Chip 2716 (4)
- RAM Chip 6116 (2)

# Components – WE 700 Temperature Sensor

- Output: 4-20mA
- Operating Voltage: 10 – 36V DC (12 V given)
- Range: -50°C – 50°C
- Resolution: 0.1°C
- Operating Temperature: 50°C – 100°C
- Warm Up Time: min 5 sec

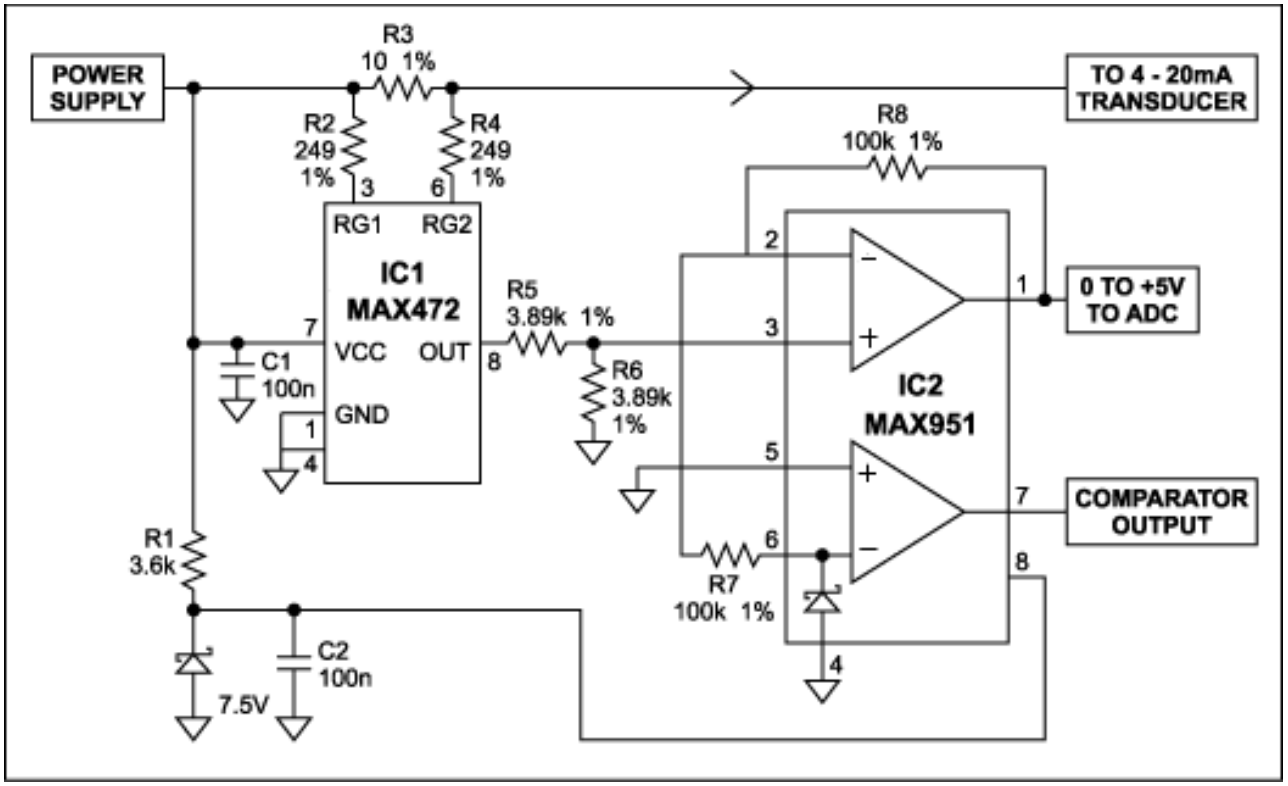
# Components – WE 100 Pressure Sensor

- Output: 4-20mA
- Range: 800-1100 millibars
- Resolution:  0.5% of full scale
- Operating Voltage: 10-36V DC  (12 V)
- Warm Up Time: 3 seconds minimum
- Operating Temp: -40° to +55°

# Components – WE 600 Humidity Sensor

- Output: 4-20mA
- Range: 0-100% RH
- Resolution: + 0.5% RH
- Operating Voltage: 10-36V DC (12 V)
- Current Draw: 3 mA plus sensor
- Warm Up Time: 3 seconds minimum
- Operating Temp: -40° to +55°C

# Current to Voltage Converter



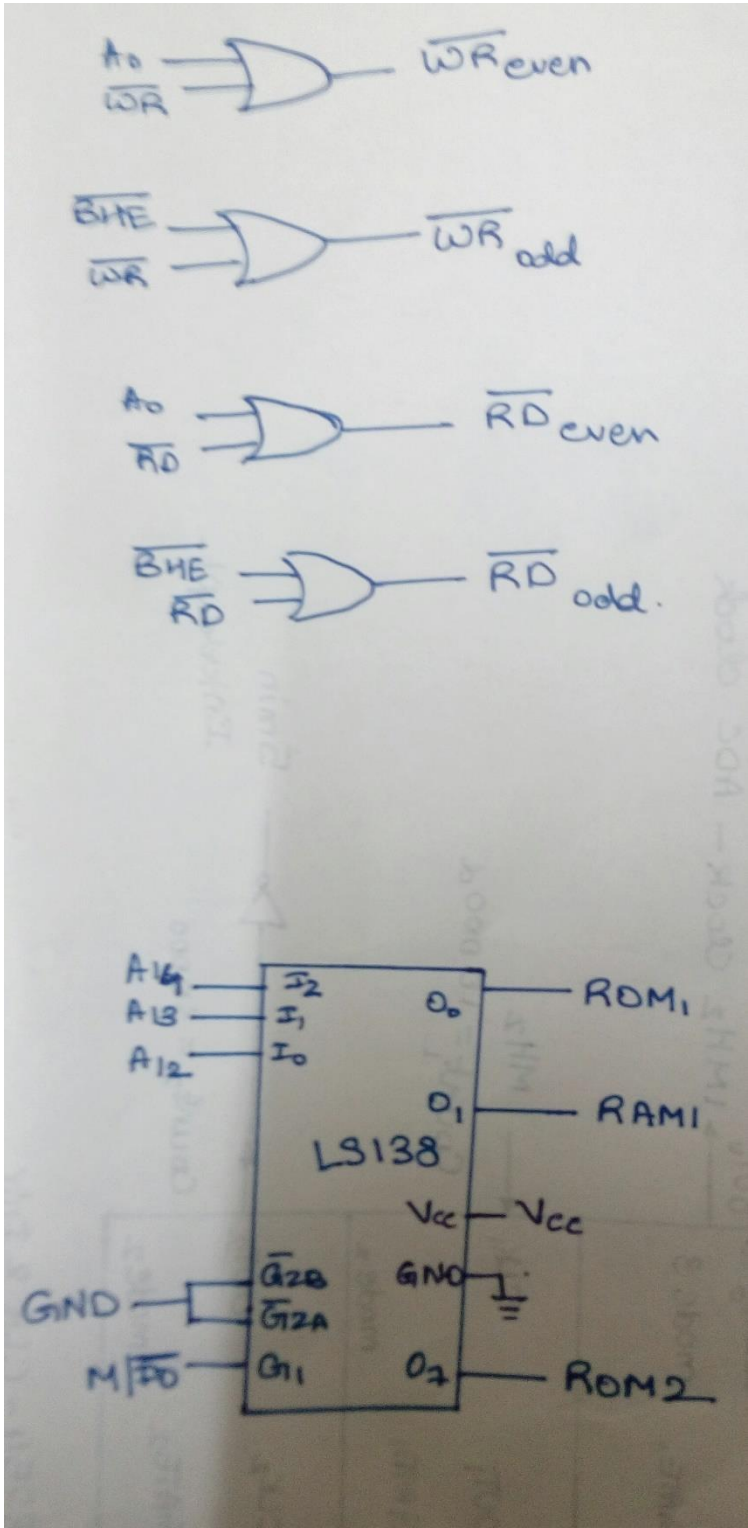
# Memory Mapping

- 4k ROM1 -$00000_H$ to $00FFF_H$
- 0000 0000 0000 0000 0000 – 0000 0000 1111 1111 1111b

- 4k ROM2 -$FF000_H$ to $FFFFF_H$
- 1111 1111 0000 0000 0000b – 1111 1111 1111 1111 1111b

- 4k RAM1 -$01000_H$ to $01FFF_H$
- 0000 0001 0000 0000 0000b – 0000 0001 1111 1111 1111b

# Memory Decoding Circuit



# I/O Map

- 8255a- $00_H$ - $06_H$
- 0000 0000b – 0000 0110b

For 7 Segment Displays

- 8255b- $08_H$ – $0E_H$
- 0000 1000b – 0000 1110b

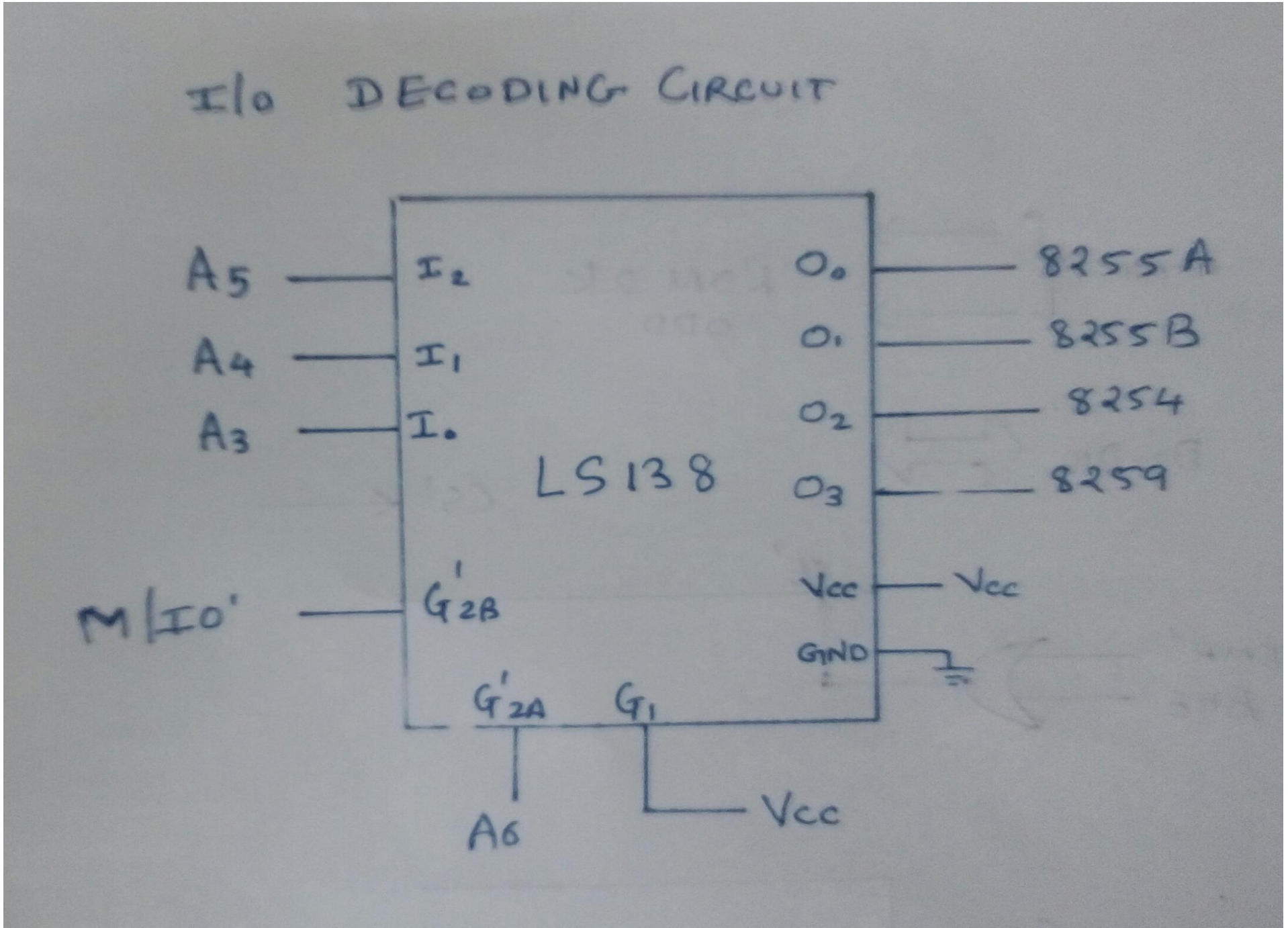
For ADC

- 8254- $10_H$ - $16_H$
- 0001 0000b – 0001 0110b

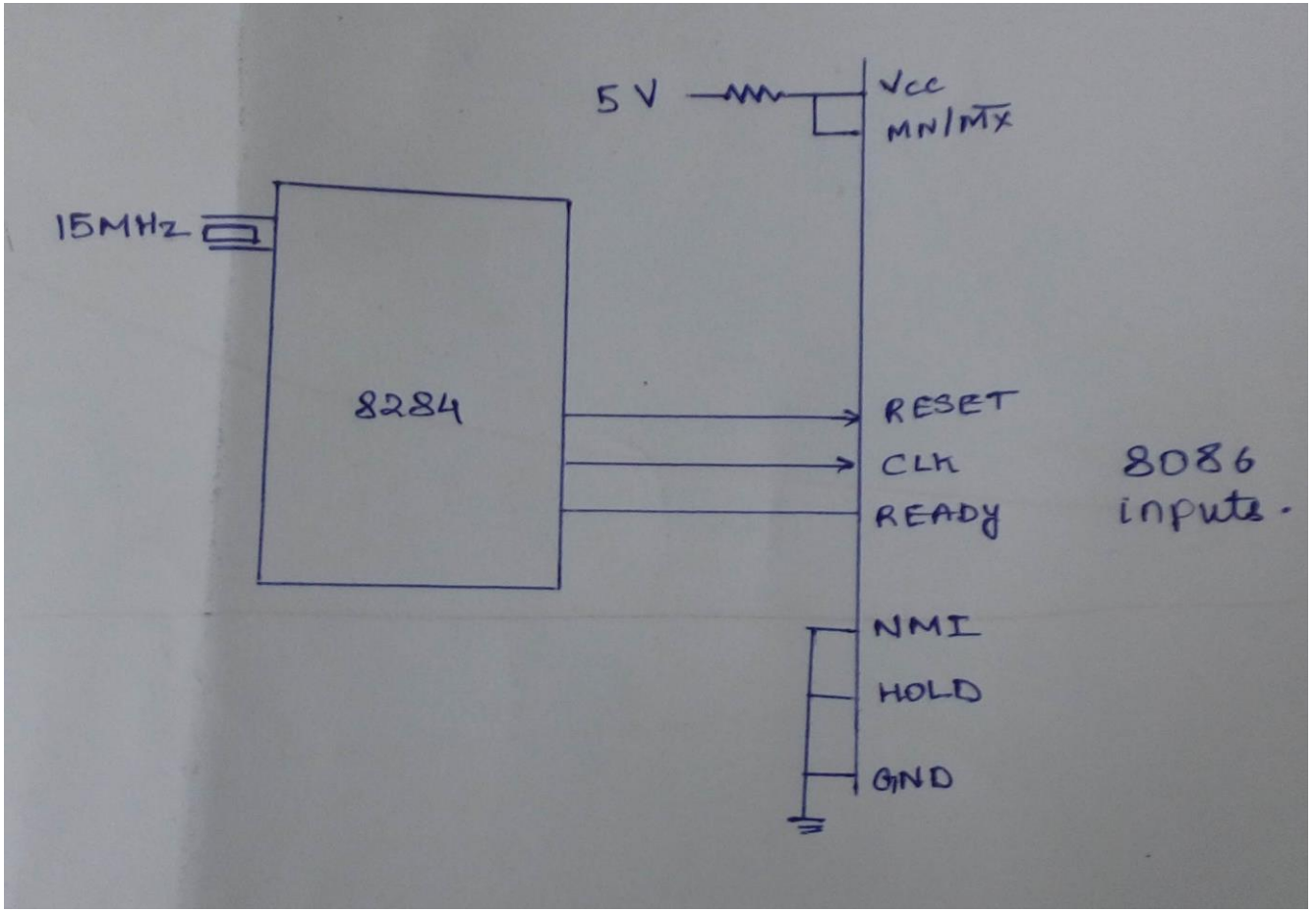
Clock and 5 Min Interrupt Generator

- 8259- $18_H$ – $1A_H$
- 0001 1000b – 0001 1010b

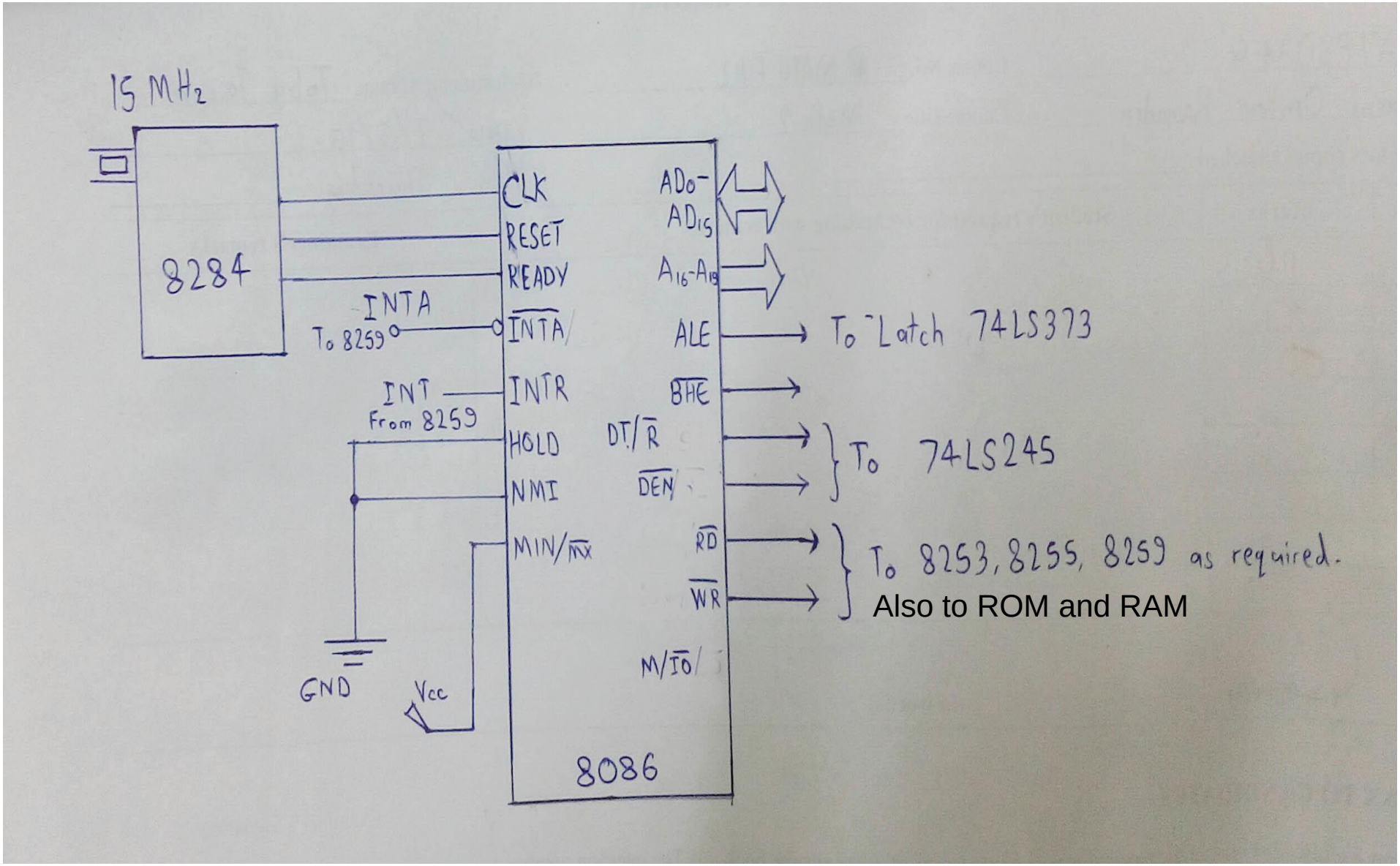
# I/O Decoding Circuit



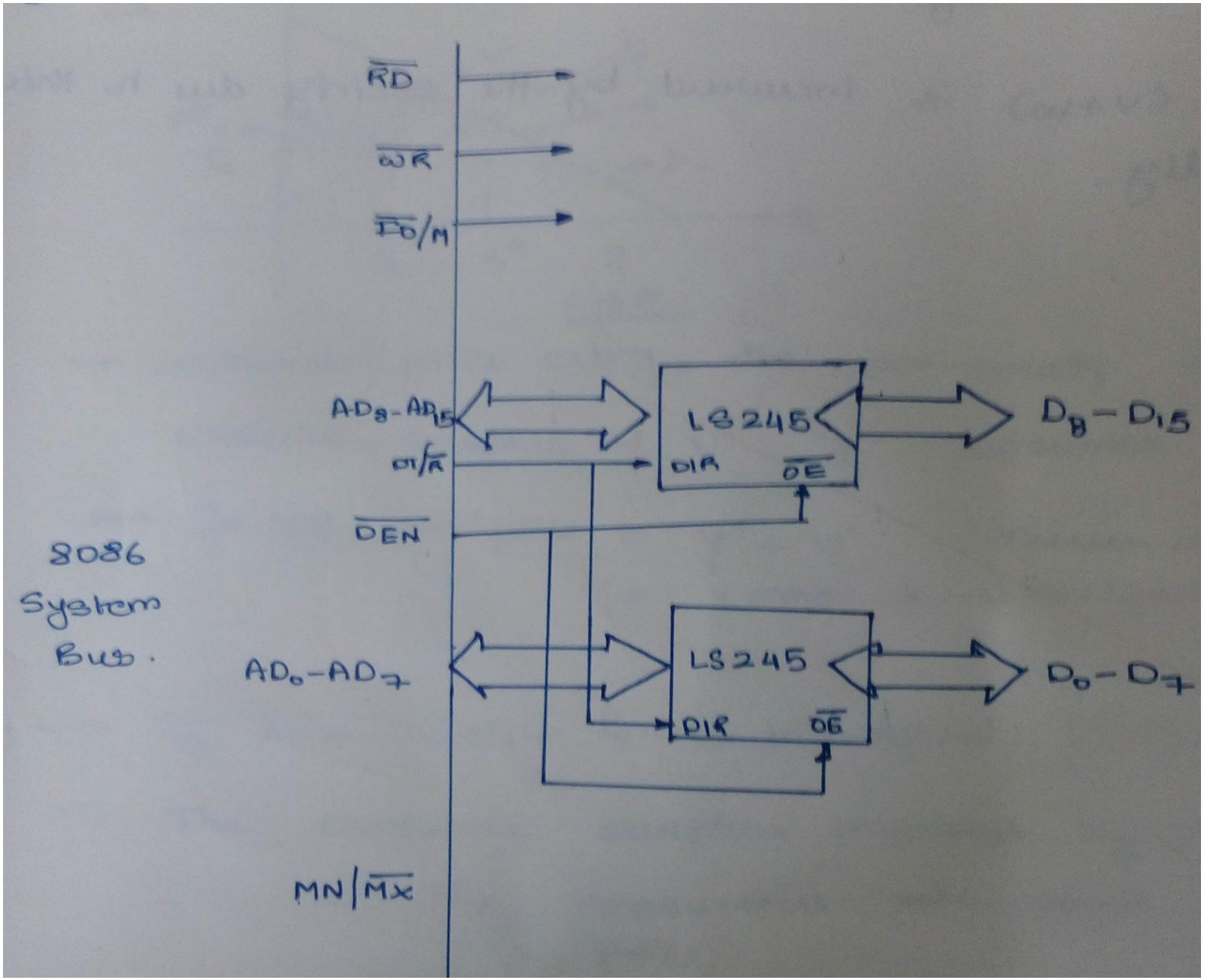
# 8284


5 V
Vcc
MN/MX
15MHz
8284
RESET
CLK
READY
8086 inputs.
NMI
HOLD
GND

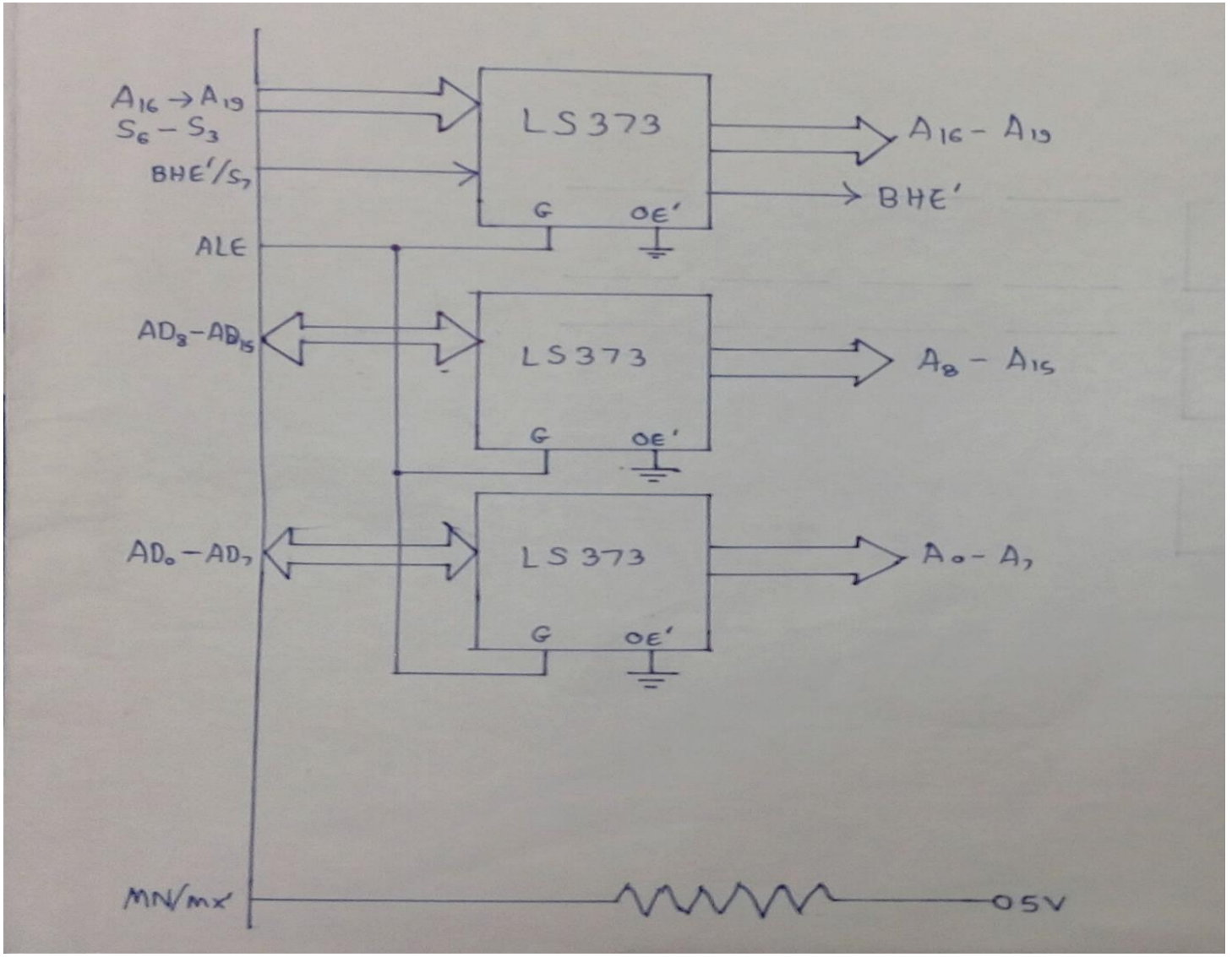
# 8086


15 MHz
8284
CLK
RESET
READY
INTA
To 8259
INTA
INT
From 8259
INTR
HOLD
NMI
MIN/MX
GND
Vcc
8086
AD0-AD15
A16-A19
ALE
To Latch 74LS373
BHE
DT/R
DEN
To 74LS245
RD
WR
To 8253, 8255, 8259 as required.
Also to ROM and RAM
M/IO

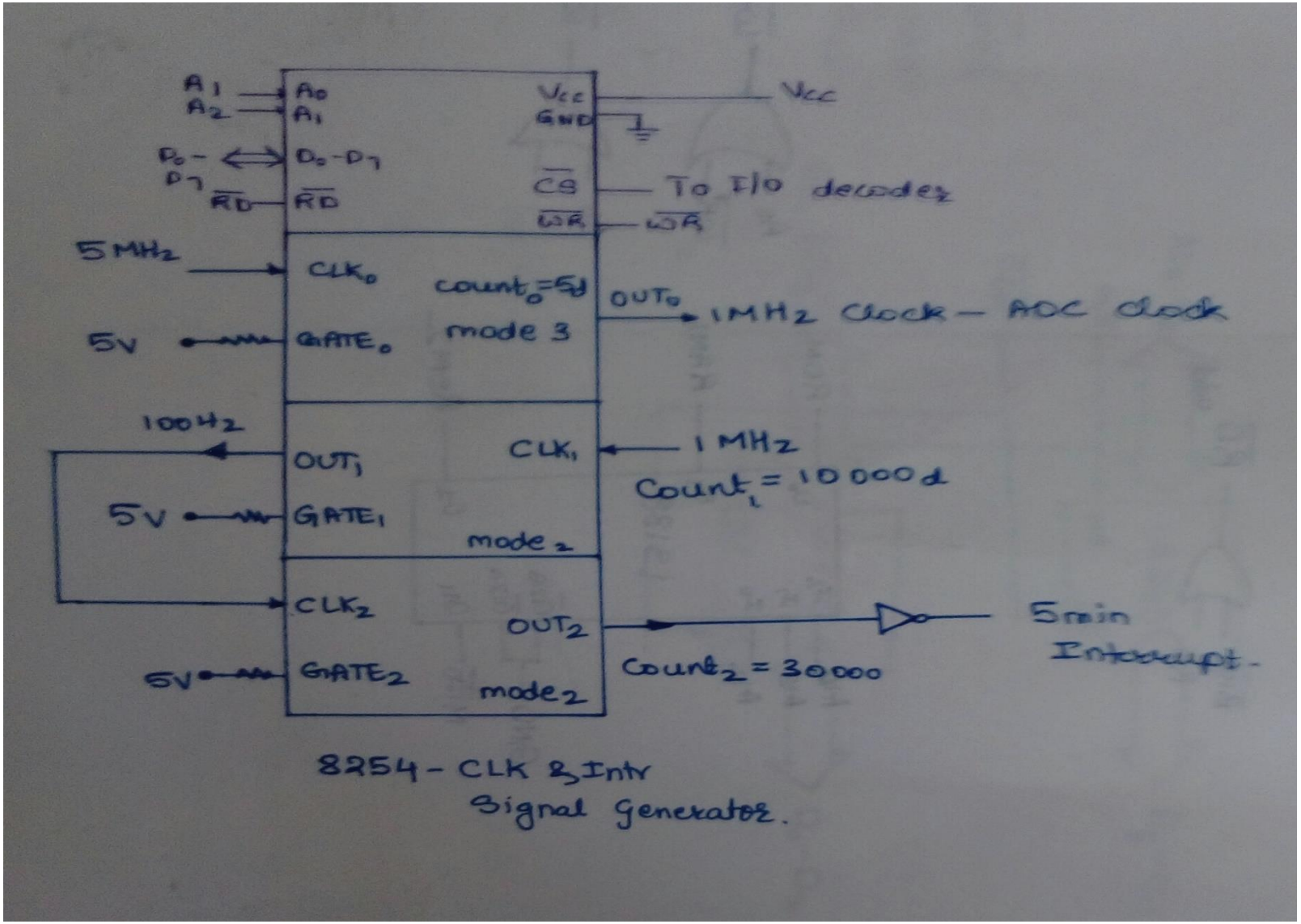
# 8086 System Bus



# 8086 System Bus(Address)

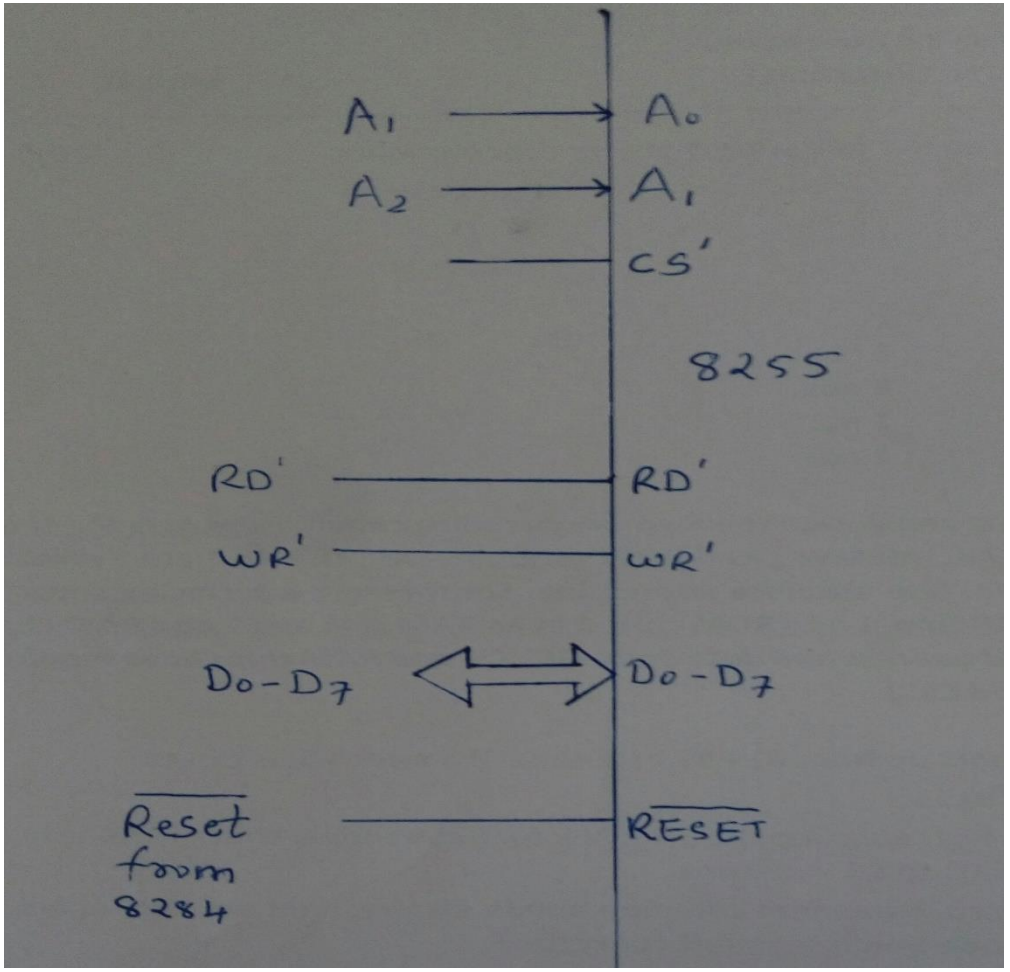


# 8254 – Clock and Intr Signal Generator




8254 - CLK & Intr Signal Generator.

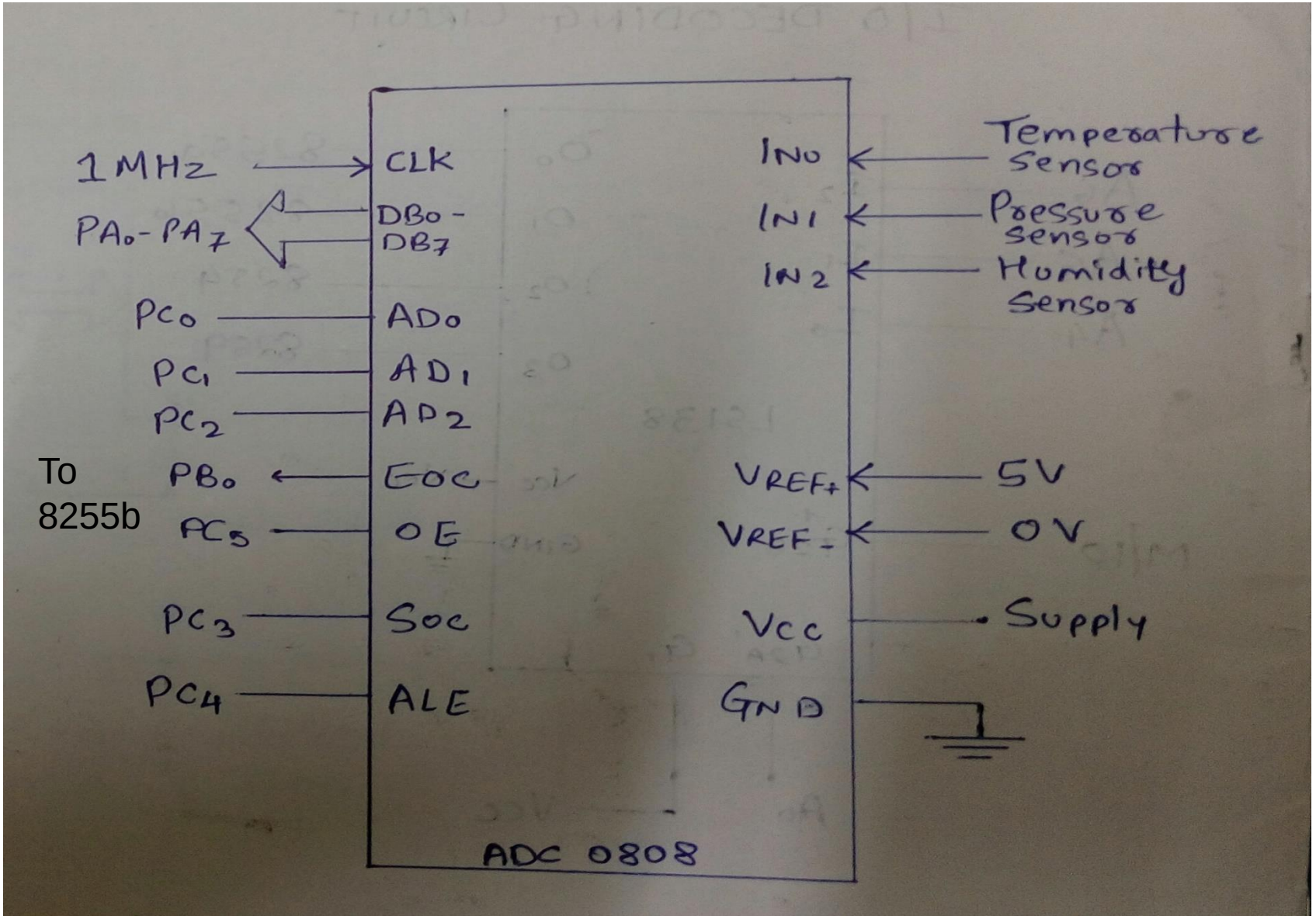
# Interfacing 8255

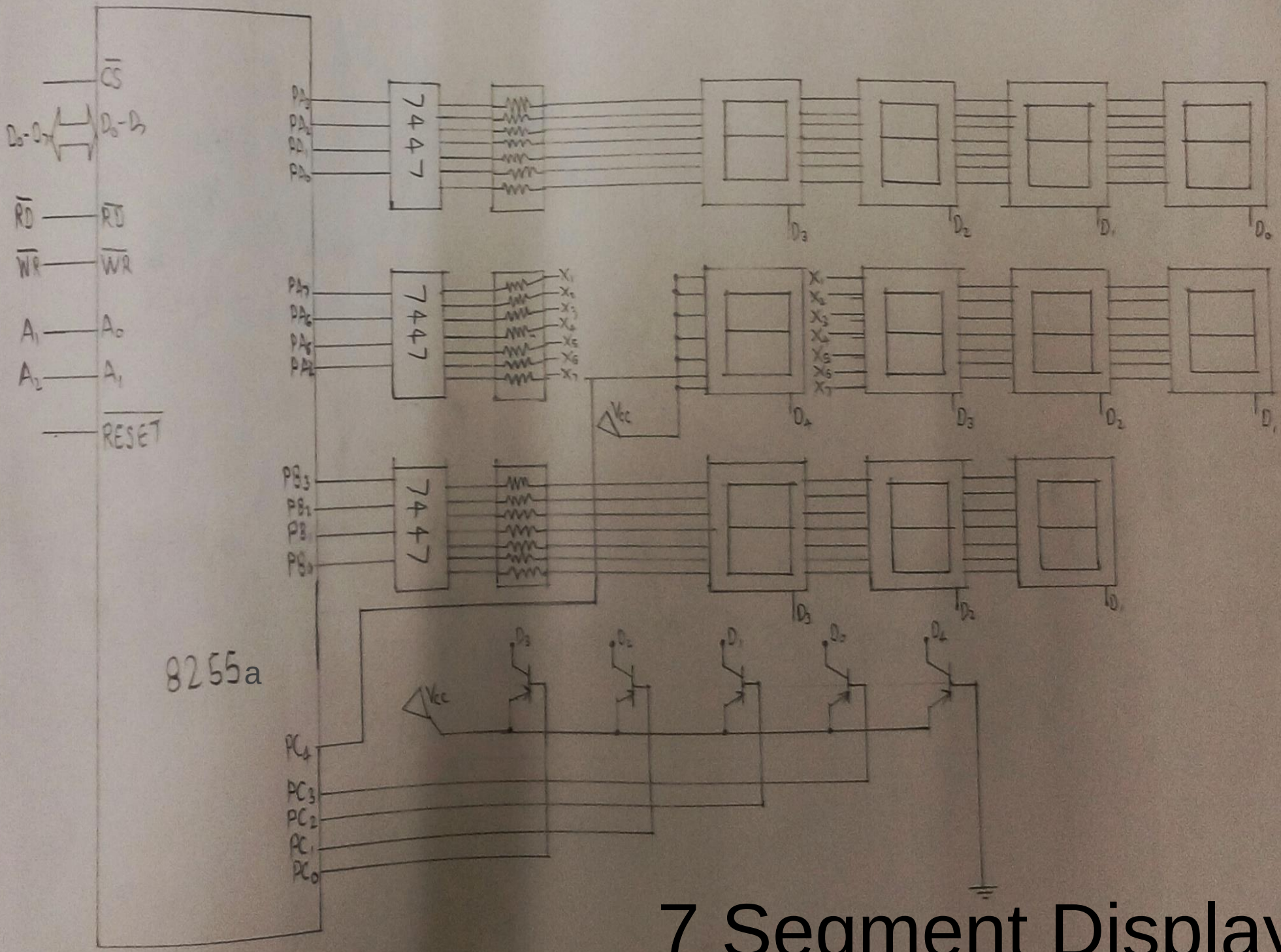


# ADC

- Size – 8 bits
- Resolution = $(V_{ref+} – V_{ref-}) / 2^8 = 19.53$ mV

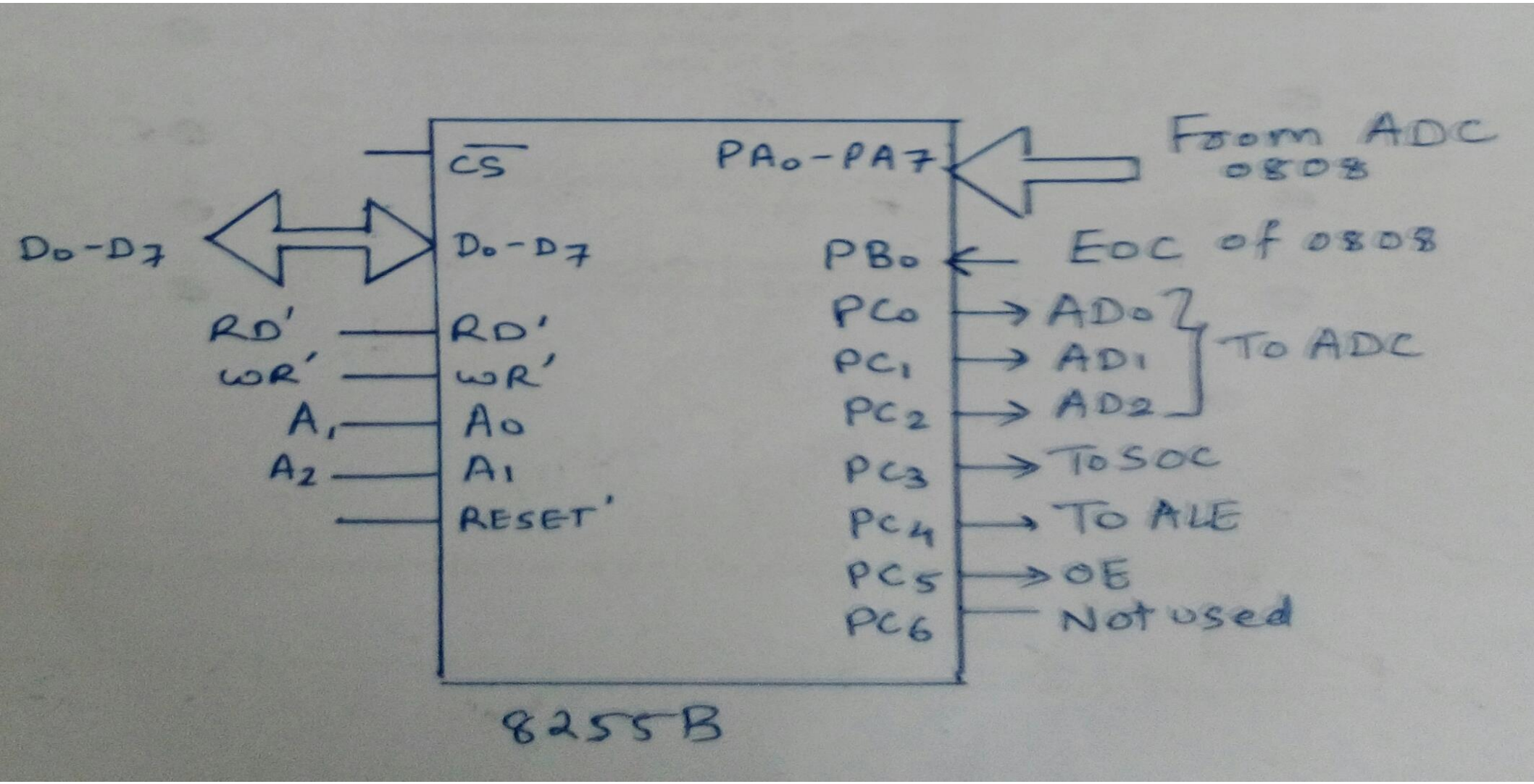
# ADC


1MHz
CLK
PA0-PA7
DB0-DB7
PC0
AD0
PC1
AD1
PC2
AD2
To 8255b
PB0
EOC
PC5
OE
PC3
SOC
PC4
ALE
IN0
Temperature Sensor
IN1
Pressure sensor
IN2
Humidity Sensor
VREF+
5V
VREF-
0V
Vcc
Supply
GND
ADC 0808

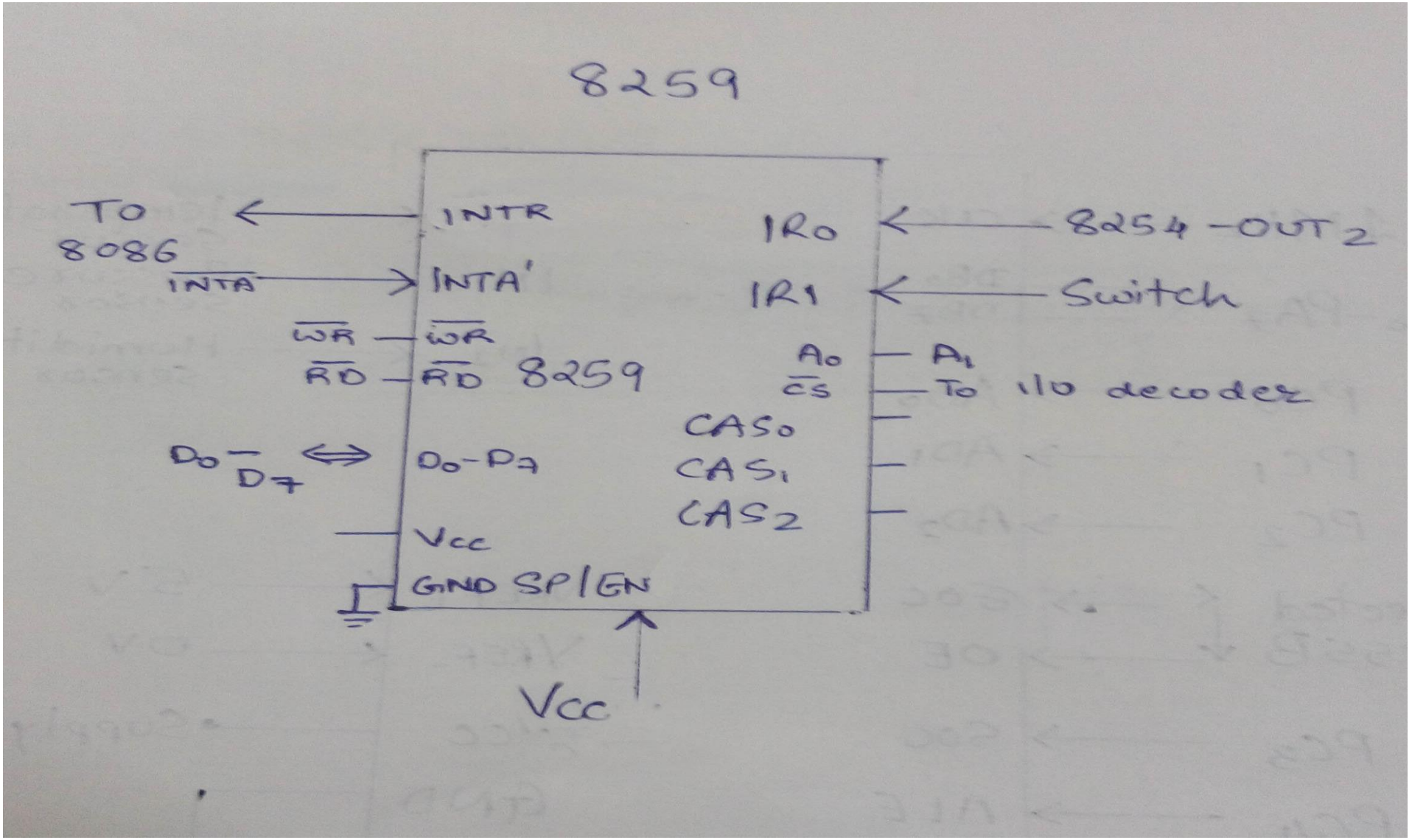



# 7 Segment Display

# 8255b


CS
PA0-PA7
From ADC 0808
D0-D7
D0-D7
PB0
EOC of 0808
RD'
RD'
PC0
AD0
WR'
WR'
PC1
AD1
To ADC
A1
A0
PC2
AD2
A2
A1
PC3
To SOC
RESET'
PC4
To ALE
PC5
OE
PC6
Not used
8255B

# 8259


8259
TO 8086
INTR
INTA
INTA'
WR
WR
RD
RD
8259
D0 - D7
D0-D7
Vcc
GND
SP/EN
IR0
IR1
A0
CS
CAS0
CAS1
CAS2
8254 - OUT 2
Switch
A1
To I/O decoder
Vcc

# Initializations

# Initialization of 8254 Counter 0

```
MOV    AL,00010110b
OUT    16H, AL
MOV AL,5
OUT 10H , AL
```

Mode 3
Count = 5
This generates 1MHz Clock for ADC

# Initialization of 8254 Counter 1

```
MOV  AL,01110100B
OUT  16H, AL
MOV AX,10000
OUT 12H , AL
MOV AL, AH
OUT 12H , AL
```

Mode 2
Count = 10000
Output of this goes to CLK2

# Initialization 8254 Counter 2

```
MOV AL,10110100B
OUT 16H ,AL
MOV AX, 30000
OUT 14H ,AL
MOV AL, AH
OUT 14H , AL
```

Mode 2
Count = 30000
Generates impulse every 5 min for interrupt

# Initialization of 8255a

```
MOV AL,10000000b
OUT 06H , AL
```

- PORT A: (O/P)
  PA4-PA7 – Temperature Display
  PA0-PA3 – Pressure Display
- PORT B: (O/P)
  PB0-3 – Humidity Display
- PORT C(Lower): (O/P)
  Enables for 7 Segment Display
- PORT C(Higher): (O/P)
  PC4 For ‘-’ Sign of Temperature Display

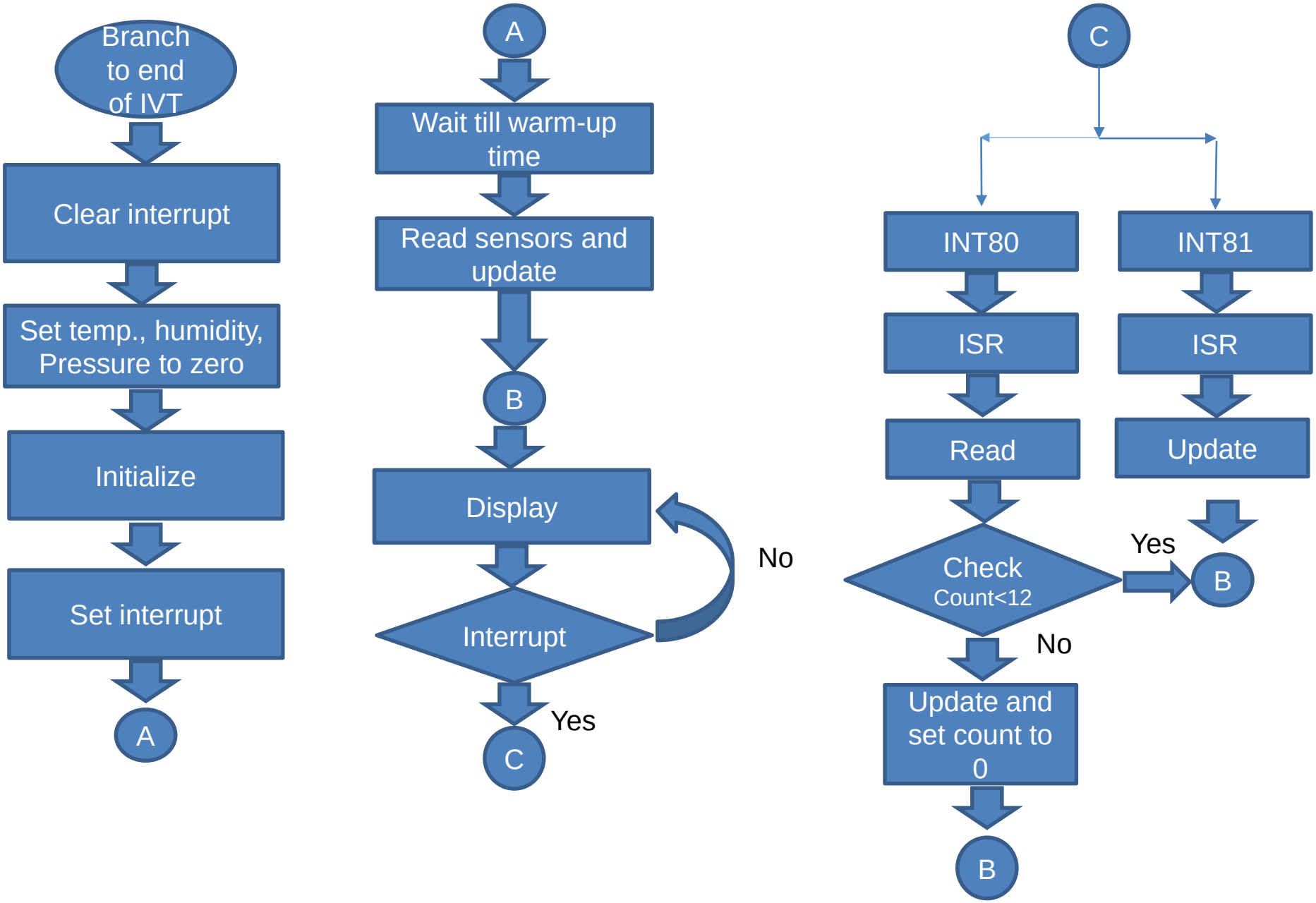
# Initialization of 8255b

```
MOV AL,10010010b
OUT 0EH , AL
```

- PORT A: (I/P) From ADC 0808
- PORT B: PB0- EOC of 0808 (I/P)
- PORT C(Lower): (O/P)
- PORT C(Higher): (O/P)

# Initialization of 8259

```
MOV AL,00010011b
OUT 18H,AL
MOV AL,40H
OUT 20H,AL
MOV AL,00000011b
OUT 20H,AL
MOV AL,11111100b
OUT 20H,AL
```


Branch to end of IVT
Clear interrupt
Set temp., humidity, Pressure to zero
Initialize
Set interrupt
A
A
Wait till warm-up time
Read sensors and update
B
Display
Interrupt
No
Yes
C
C
INT80
INT81
ISR
ISR
Read
Update
Check
Count<12
Yes
B
No
Update and set count to 0
B

# Acknowledgement

We would like to thank the entire MPI course staff for guiding us in the project. Mr Kadam Bhushan, our mentor offered some useful insights. We also used the slides of Dr Anupama in the making of this project.

We got information on the sensors and the ICs from the internet.

# Bibliography


- http://www.globalw.com/products/we700.html
- http://www.fondriest.com/pdf/global_water_we700_spec.pdf
- www.globalw.com/downloads/WE/**WE100**B.pdf