# MEMORY SYSTEM

## 8086 uP

U9

| Pin | Signal | Signal | Pin |
|---|---|---|---|
| 21 | RESET | AD[0..15] | |
| 22 | READY | A[16..19] | |
| 24 | INTA/QS1 | | |
| 18 | INTR | ALE/QS0 | 25 |
| 31 | HOLD/GT1 | BHE | 34 |
| 30 | HLDA/GT0 | DT/R/S1 | 27 |
| 23 | TEST | DEN/S2 | 26 |
| 17 | NMI | RD | 32 |
| 33 | MN/MX | WR/LOCK | 29 |
| 19 | CLK | M/IO/S0 | 28 |

ALE
DT/R
DEN
RD
WR
M/IO

INTA
INTR

AD[0..15]

8086

## Address Latch and Data Buffer
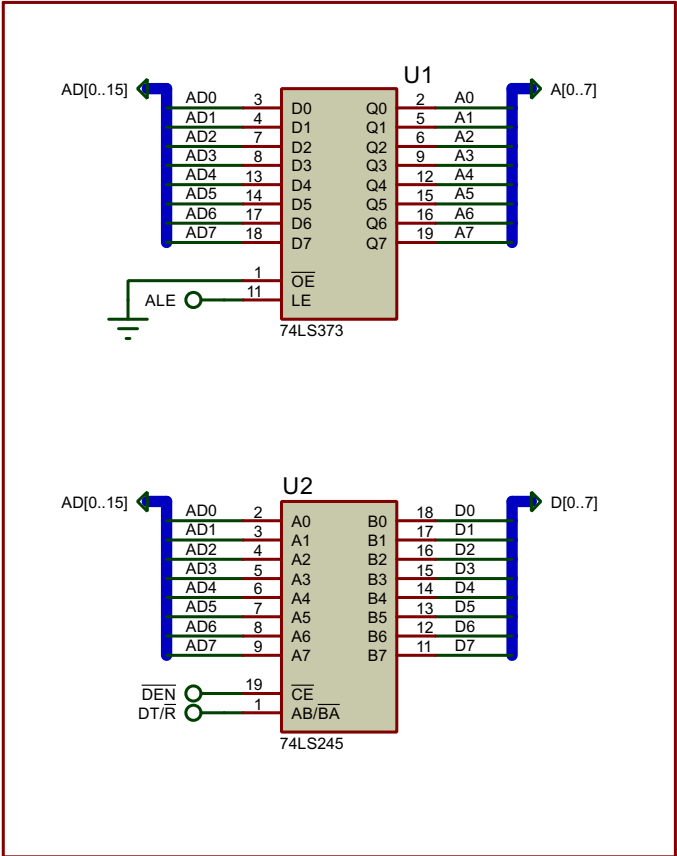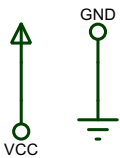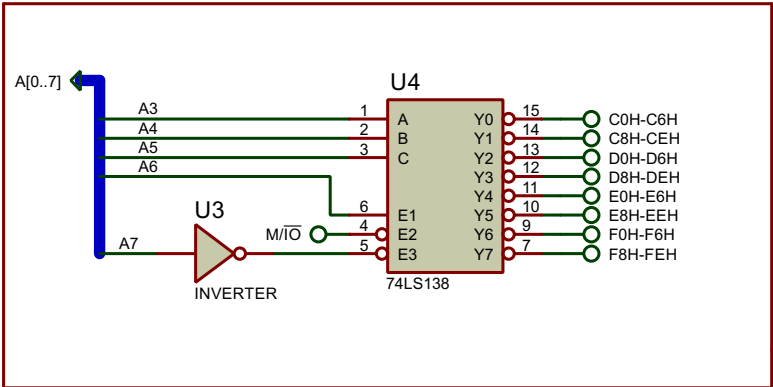
U1

AD[0..15]    A[0..7]

| D | Pin | Q | Pin | A |
|---|---|---|---|---|
| AD0 | 3 | D0 Q0 | 2 | A0 |
| AD1 | 4 | D1 Q1 | 5 | A1 |
| AD2 | 7 | D2 Q2 | 6 | A2 |
| AD3 | 8 | D3 Q3 | 9 | A3 |
| AD4 | 13 | D4 Q4 | 12 | A4 |
| AD5 | 14 | D5 Q5 | 15 | A5 |
| AD6 | 17 | D6 Q6 | 16 | A6 |
| AD7 | 18 | D7 Q7 | 19 | A7 |

1 OE
11 LE
ALE

74LS373

U2

AD[0..15]    D[0..7]

| A | Pin | B | Pin | D |
|---|---|---|---|---|
| AD0 | 2 | A0 B0 | 18 | D0 |
| AD1 | 3 | A1 B1 | 17 | D1 |
| AD2 | 4 | A2 B2 | 16 | D2 |
| AD3 | 5 | A3 B3 | 15 | D3 |
| AD4 | 6 | A4 B4 | 14 | D4 |
| AD5 | 7 | A5 B5 | 13 | D5 |
| AD6 | 8 | A6 B6 | 12 | D6 |
| AD7 | 9 | A7 B7 | 11 | D7 |

19 CE
1 AB/BA

DEN
DT/R

74LS245

## Address Decoder

A[0..7]

U4

| Pin | In | Out | Pin | Signal |
|---|---|---|---|---|
| A3 | 1 | A Y0 | 15 | C0H-C6H |
| A4 | 2 | B Y1 | 14 | C8H-CEH |
| A5 | 3 | C Y2 | 13 | D0H-D6H |
| A6 | | Y3 | 12 | D8H-DEH |
| | 6 | E1 Y4 | 11 | E0H-E6H |
| | 4 | E2 Y5 | 10 | E8H-EEH |
| | 5 | E3 Y6 | 9 | F0H-F6H |
| | | Y7 | 7 | F8H-FEH |

U3
INVERTER

A7    M/IO

74LS138

VCC
GND

# PERIPHERAL DEVICES

## 8253A Timer
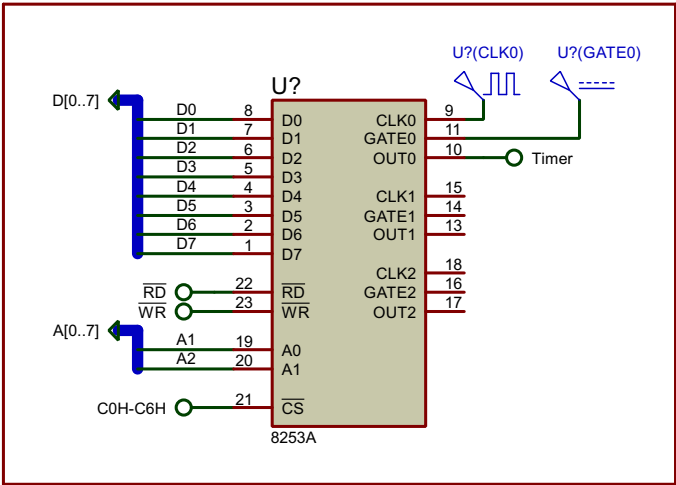


## Keypad Encoder
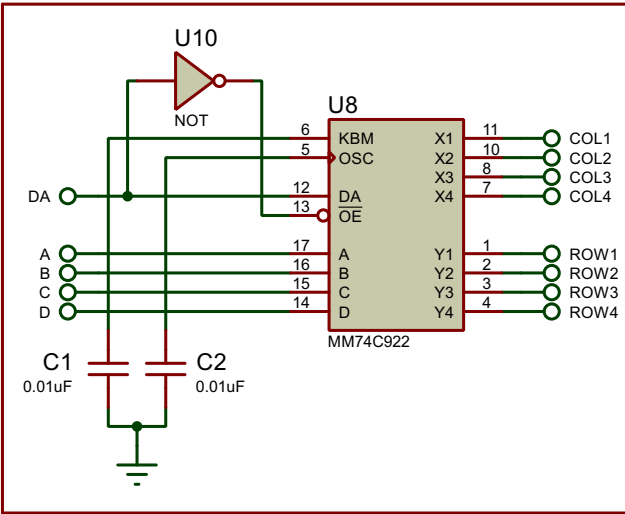


## 8259 IC
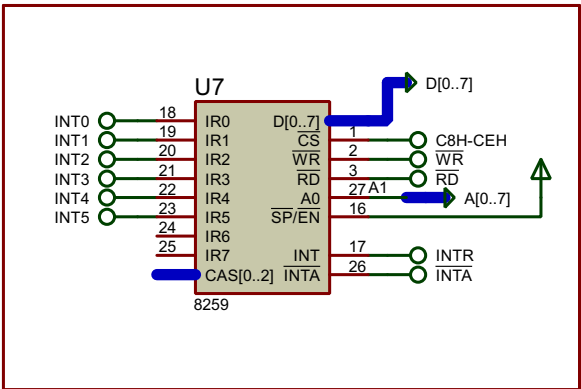
# PERIPHERAL INTERFACES

## LCD & Keypad PPI

U10 (ABC)

| Pin | Signal | | Pin | Signal |
|---|---|---|---|---|
| D[0..7] | D0 | 34 / D0 | PA0 | 4 / LCD0 |
| | D1 | 33 / D1 | PA1 | 3 / LCD1 |
| | D2 | 32 / D2 | PA2 | 2 / LCD2 |
| | D3 | 31 / D3 | PA3 | 1 / LCD3 |
| | D4 | 30 / D4 | PA4 | 40 / LCD4 |
| | D5 | 29 / D5 | PA5 | 39 / LCD5 |
| | D6 | 28 / D6 | PA6 | 38 / LCD6 |
| | D7 | 27 / D7 | PA7 | 37 / LCD7 |

$\overline{RD}$  5  $\overline{RD}$   PB0  18  LCD_RS
$\overline{WR}$  36  $\overline{WR}$   PB1  19  LCD_E
A1  9  A0   PB2  20
A2  8  A1   PB3  21
GND  35  RESET   PB4  22
  PB5  23
D0H-D6H  6  $\overline{CS}$   PB6  24
  PB7  25

PC0  14  A
PC1  15  B
PC2  16  C
PC3  17  D
PC4  13  DA
PC5  12
PC6  11
PC7  10  GND

8255A

## ADC & Interrupt PPI

U23 (DEF)

| Pin | Signal | | Pin | Signal |
|---|---|---|---|---|
| D[0..7] | D0 | 34 / D0 | PA0 | 4 / ADC_OUT1 |
| | D1 | 33 / D1 | PA1 | 3 / ADC_OUT2 |
| | D2 | 32 / D2 | PA2 | 2 / ADC_OUT3 |
| | D3 | 31 / D3 | PA3 | 1 / ADC_OUT4 |
| | D4 | 30 / D4 | PA4 | 40 / ADC_OUT5 |
| | D5 | 29 / D5 | PA5 | 39 / ADC_OUT6 |
| | D6 | 28 / D6 | PA6 | 38 / ADC_OUT7 |
| | D7 | 27 / D7 | PA7 | 37 / ADC_OUT8 |

$\overline{RD}$  5  $\overline{RD}$   PB0  18  ADC_ADDA
$\overline{WR}$  36  $\overline{WR}$   PB1  19  ADC_ADDB
A1  9  A0   PB2  20  ADC_ADDC
A2  8  A1   PB3  21
GND  35  RESET   PB4  22
  PB5  23
D8H-DEH  6  $\overline{CS}$   PB6  24
  PB7  25  GND

PC0  14  INT0
PC1  15  INT1
PC2  16  INT2
PC3  17  INT3
PC4  13  INT4
PC5  12  INT5
PC6  11
PC7  10

8255A

# PERIPHERAL INTERFACES

## Timer & Buzzer PPI



U24 (GHI)

8255A

Pins:
- D0 34, D1 33, D2 32, D3 31, D4 30, D5 29, D6 28, D7 27
- RD 5, WR 36, A1 9, A2 8, GND 35, E0H-E6H 6
- PA0 4, PA1 3 → BUZZER, PA2 2, PA3 1, PA4 40, PA5 39, PA6 38, PA7 37
- PB0 18 → Timer, PB1 19, PB2 20, PB3 21, PB4 22, PB5 23, PB6 24, PB7 25 → GND
- PC0 14, PC1 15, PC2 16, PC3 17, PC4 13, PC5 12, PC6 11, PC7 10

## Fans & Speed PPI

U21 (JKL)

8255A

Pins:
- D0 34, D1 33, D2 32, D3 31, D4 30, D5 29, D6 28, D7 27
- RD 5, WR 36, A1 9, A2 8, GND 35, F0H-F6H 6
- PA0 4 → FAN1, PA1 3 → FAN2, PA2 2, PA3 1, PA4 40, PA5 39, PA6 38, PA7 37
- PB0 18 → ROOM1_BIT1, PB1 19 → ROOM1_BIT2, PB2 20, PB3 21, PB4 22, PB5 23, PB6 24, PB7 25
- PC0 14 → FAN3, PC1 15 → FAN4, PC2 16, PC3 17, PC4 13, PC5 12, PC6 11, PC7 10

U22 (MNO)

8255A

Pins:
- D0 34, D1 33, D2 32, D3 31, D4 30, D5 29, D6 28, D7 27
- RD 5, WR 36, A1 9, A2 8, GND 35, F8H-FEH 6
- PA0 4 → ROOM2_BIT1, PA1 3 → ROOM2_BIT2, PA2 2, PA3 1, PA4 40, PA5 39, PA6 38, PA7 37
- PB0 18 → FAN5, PB1 19 → FAN6, PB2 20, PB3 21, PB4 22, PB5 23, PB6 24, PB7 25
- PC0 14 → ROOM3_BIT1, PC1 15 → ROOM3_BIT2, PC2 16, PC3 17, PC4 13, PC5 12, PC6 11, PC7 10

DESIGN TITLE: **Building Control System**

REV: 1

BY: Aguilar, Sean Karl Tyrese G.
Alotaya, Isaac Jadon R.
Caños, Bea Belle Therese B.

*Software*
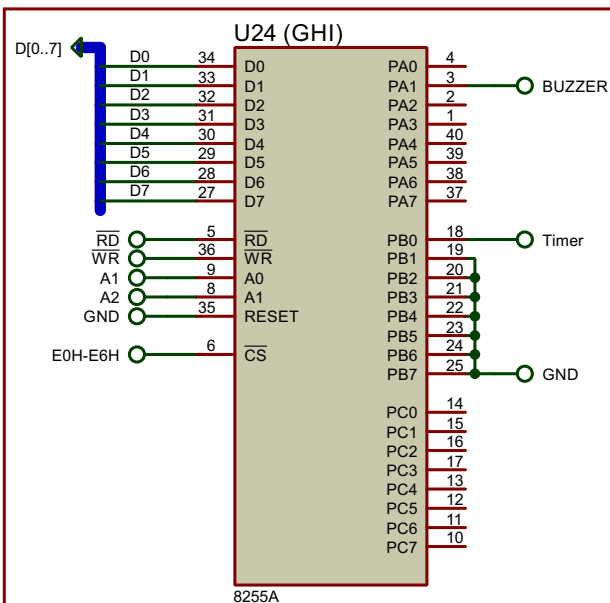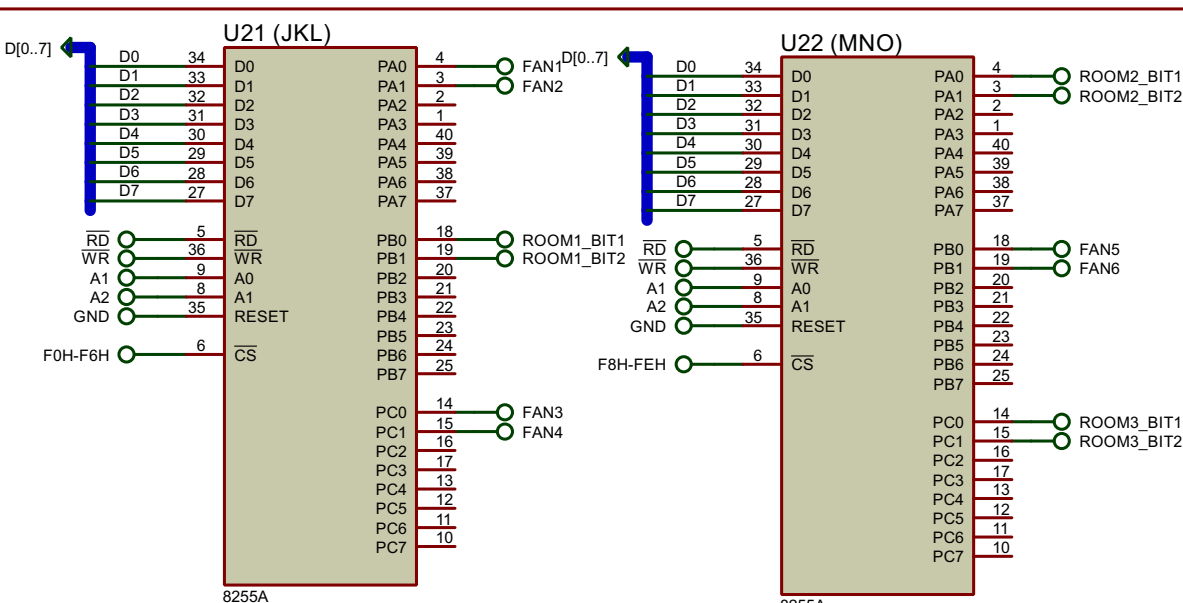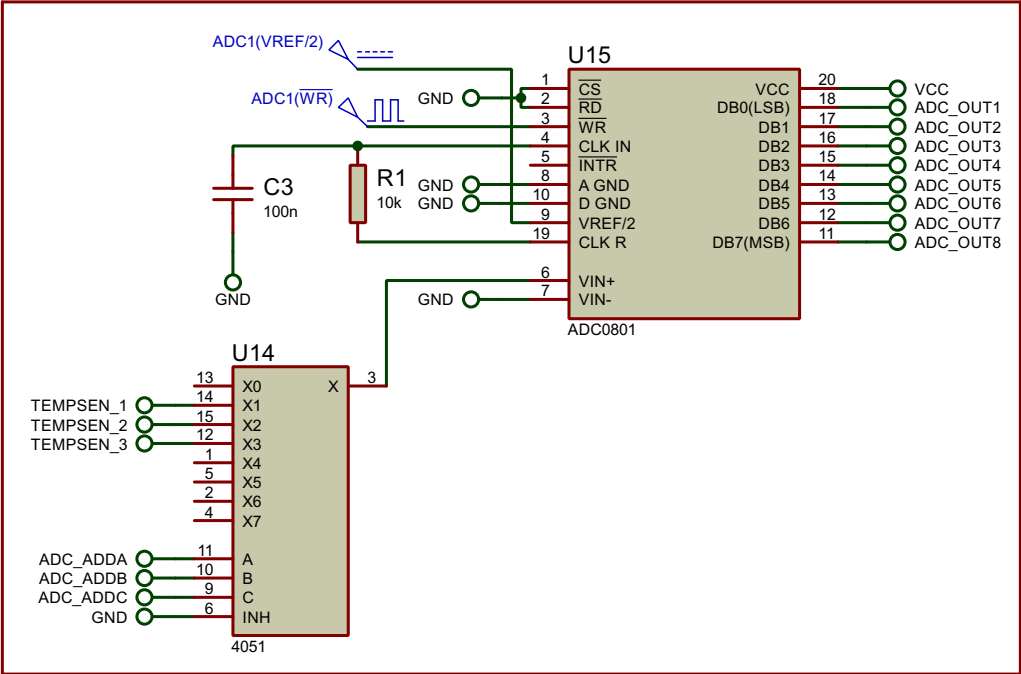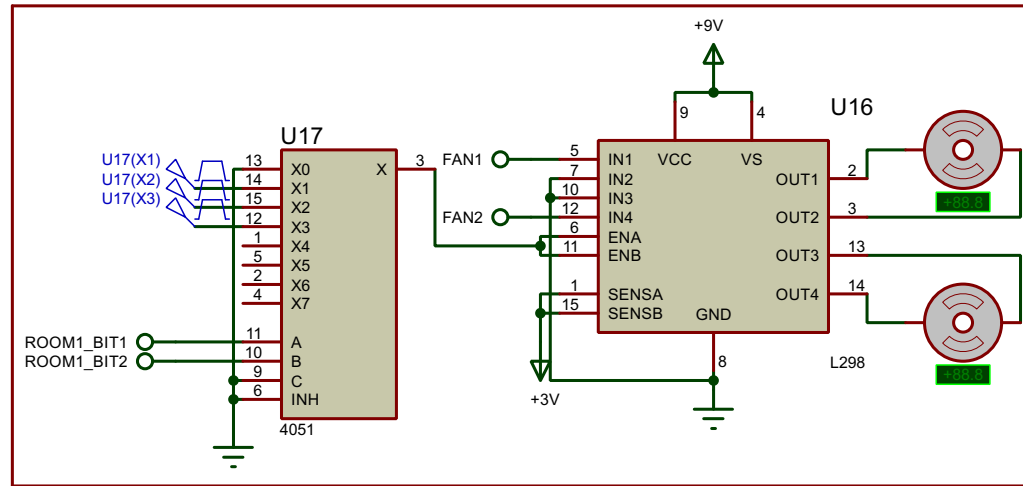*Documentation*
*Hardware*

DATE: **11/27/2024**
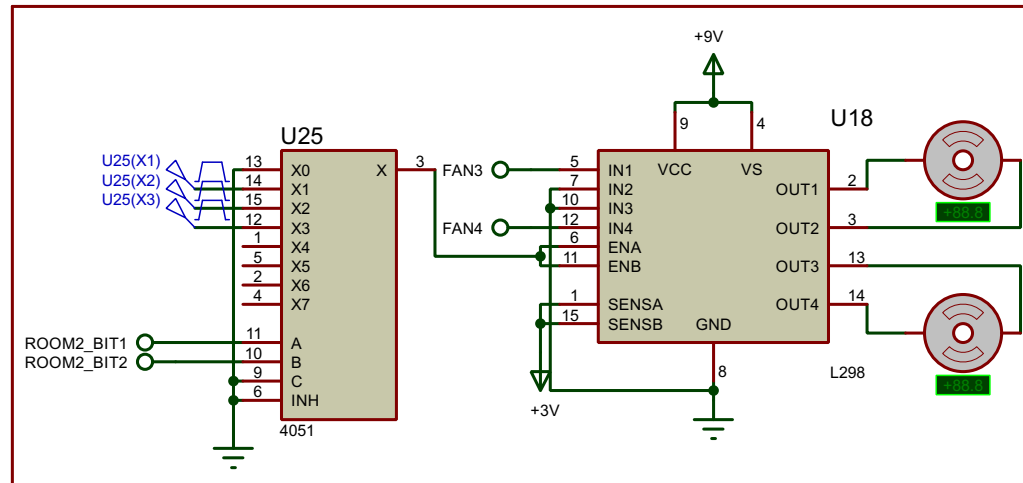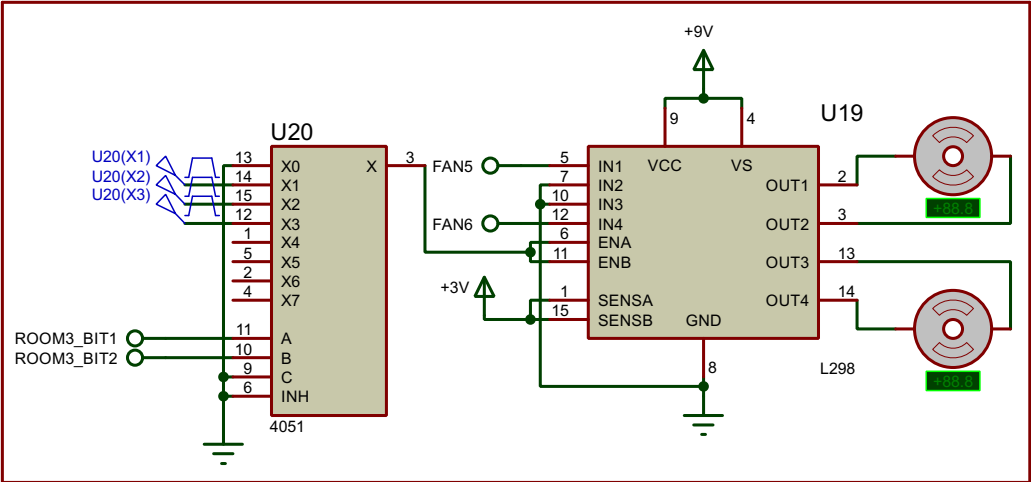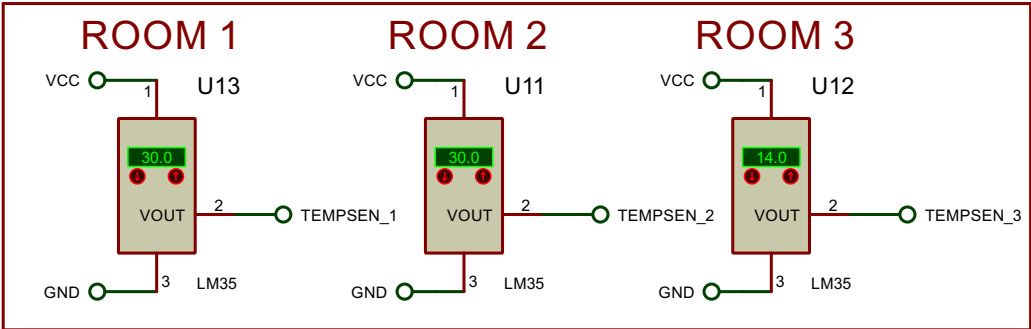
# ANALOG TO DIGITAL CONVERTER



**U15**

| Pin | Name | | Name | Pin |
|---|---|---|---|---|
| 1 | $\overline{CS}$ | | VCC | 20 |
| 2 | $\overline{RD}$ | | DB0(LSB) | 18 |
| 3 | $\overline{WR}$ | | DB1 | 17 |
| 4 | CLK IN | | DB2 | 16 |
| 5 | $\overline{INTR}$ | | DB3 | 15 |
| 8 | A GND | | DB4 | 14 |
| 10 | D GND | | DB5 | 13 |
| 9 | VREF/2 | | DB6 | 12 |
| 19 | CLK R | | DB7(MSB) | 11 |
| 6 | VIN+ | | | |
| 7 | VIN- | | | |

ADC0801

ADC1(VREF/2)
ADC1($\overline{WR}$)

GND
GND
GND
GND

C3 100n
R1 10k
GND

VCC
ADC_OUT1
ADC_OUT2
ADC_OUT3
ADC_OUT4
ADC_OUT5
ADC_OUT6
ADC_OUT7
ADC_OUT8

**U14**

| Pin | Name | | Name | Pin |
|---|---|---|---|---|
| 13 | X0 | | X | 3 |
| 14 | X1 | | | |
| 15 | X2 | | | |
| 12 | X3 | | | |
| 1 | X4 | | | |
| 5 | X5 | | | |
| 2 | X6 | | | |
| 4 | X7 | | | |
| 11 | A | | | |
| 10 | B | | | |
| 9 | C | | | |
| 6 | INH | | | |

4051

TEMPSEN_1
TEMPSEN_2
TEMPSEN_3

ADC_ADDA
ADC_ADDB
ADC_ADDC
GND

# AIRCON FOR ROOM 1

+9V

U17

| Pin | Label | |
|---|---|---|
| 13 | X0 | |
| 14 | X1 | |
| 15 | X2 | |
| 12 | X3 | |
| 1 | X4 | |
| 5 | X5 | |
| 2 | X6 | |
| 4 | X7 | |

U17(X1)
U17(X2)
U17(X3)

X  3  FAN1

FAN2

ROOM1_BIT1  11  A
ROOM1_BIT2  10  B
9  C
6  INH

4051

U16

IN1  VCC  VS
IN2
IN3
IN4
ENA
ENB

SENSA
SENSB  GND

OUT1  2
OUT2  3
OUT3  13
OUT4  14

L298

+88.8

+3V  8

# AIRCON FOR ROOM 2

+9V

U25

| Pin | Label | |
|---|---|---|
| 13 | X0 | |
| 14 | X1 | |
| 15 | X2 | |
| 12 | X3 | |
| 1 | X4 | |
| 5 | X5 | |
| 2 | X6 | |
| 4 | X7 | |

U25(X1)
U25(X2)
U25(X3)

X  3  FAN3

FAN4

ROOM2_BIT1  11  A
ROOM2_BIT2  10  B
9  C
6  INH

4051

U18

IN1  VCC  VS
IN2
IN3
IN4
ENA
ENB

SENSA
SENSB  GND

OUT1  2
OUT2  3
OUT3  13
OUT4  14

L298

+88.8

+3V  8

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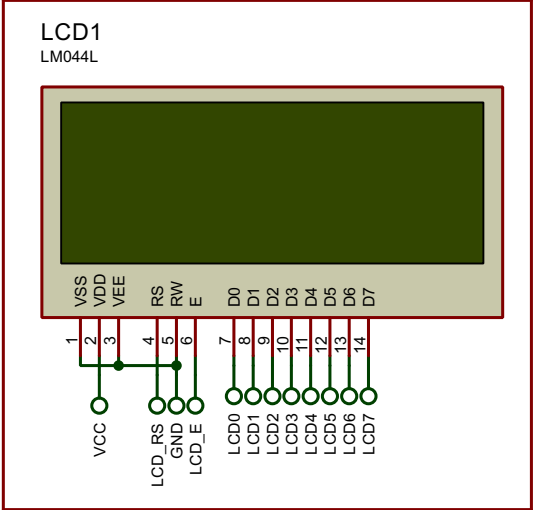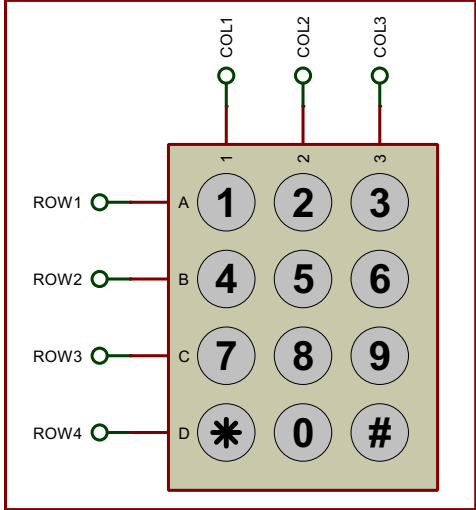Hardware*

DATE:

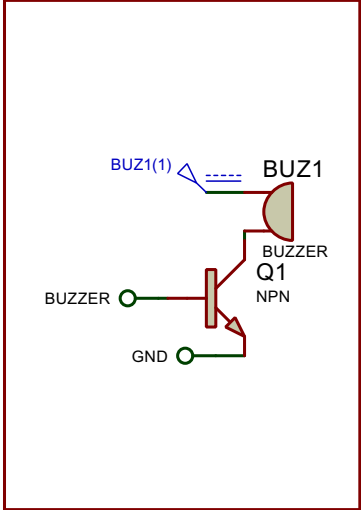**11/27/2024**

# AIRCON FOR ROOM 3

+9V

**U20**

U20(X1) 13 X0
U20(X2) 14 X1
U20(X3) 15 X2
12 X3
1 X4
5 X5
2 X6
4 X7

3 X — FAN5

FAN6

ROOM3_BIT1 11 A
ROOM3_BIT2 10 B
9 C
6 INH

4051

**U19**

5 IN1    VCC    VS
7 IN2
10 IN3
12 IN4
6 ENA
11 ENB

2 OUT1
3 OUT2
13 OUT3
14 OUT4

+3V
1 SENSA
15 SENSB    GND
8

L298

+88.8

+88.8

# TEMPERATURE SENSOR

## ROOM 1

VCC
1 **U13**

30.0

VOUT    2 — TEMPSEN_1

GND    3 LM35

## ROOM 2

VCC
1 **U11**

30.0

VOUT    2 — TEMPSEN_2

GND    3 LM35

## ROOM 3

VCC
1 **U12**

14.0

VOUT    2 — TEMPSEN_3

GND    3 LM35

# USER INTERFACE

# DISPLAY

**LCD1**
LM044L

VSS VDD VEE RS RW E D0 D1 D2 D3 D4 D5 D6 D7

1 2 3 4 5 6 7 8 9 10 11 12 13 14

VCC LCD_RS GND LCD_E LCD0 LCD1 LCD2 LCD3 LCD4 LCD5 LCD6 LCD7

# KEYPAD

COL1 COL2 COL3

1 2 3

ROW1 — A (1) (2) (3)

ROW2 — B (4) (5) (6)

ROW3 — C (7) (8) (9)

ROW4 — D (✳) (0) (#)

# BUZZER

BUZ1(1) BUZ1

BUZZER
Q1
NPN

BUZZER

GND

# USER INTERFACE