Experiment Name: Blinking LED using pic Microcontroller

Objective(s):

① Desiging a LED blinking circuit
② Understanding the circuit diggram of PIC Microcontroler

Theory: LED's are small powerful lights that are used in many application. It is as simple as light turning on and off. LED is a electronic device, which its terminals.

An LED is a two-terminal device. The two terminals are called as cathode an anode

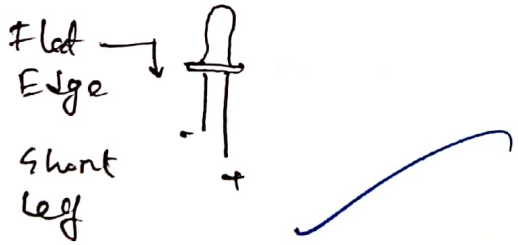


fig: a structure of LED

Apparatus Required's:

LED, pic16F877A, power supply, resistor crystal oscilator, capaciton.

circuit diagram:-

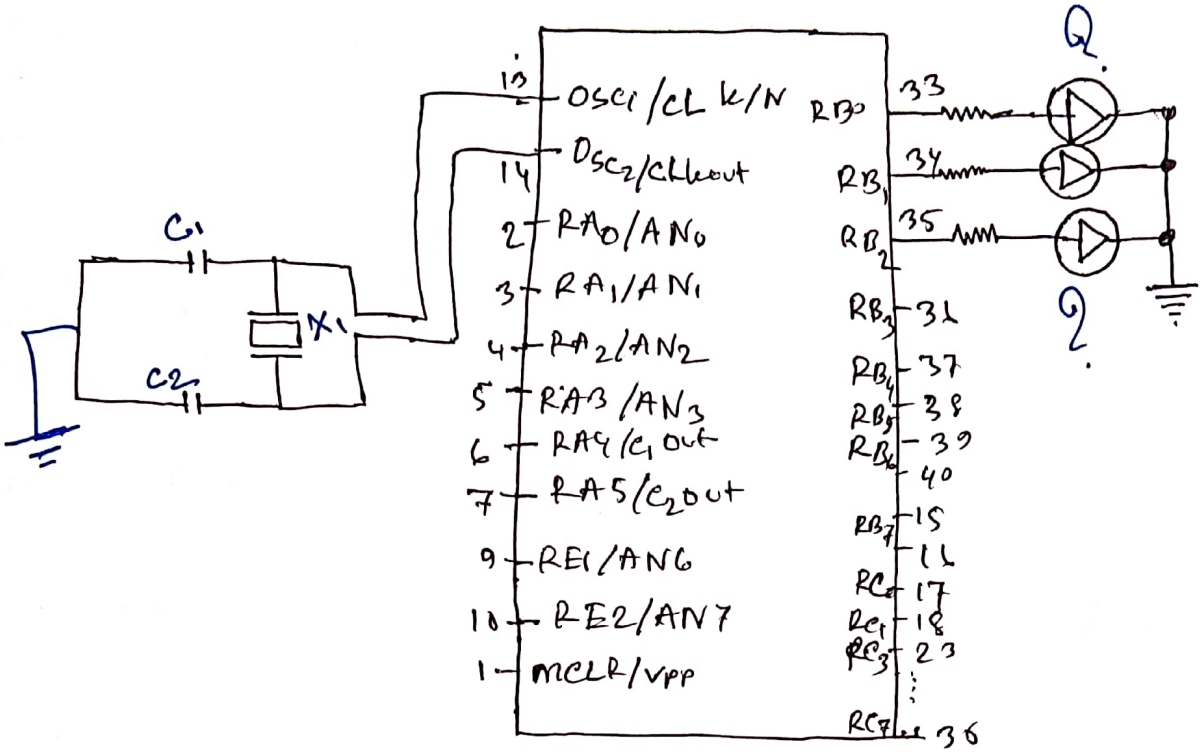


Figure No: 1.0 PIC 16F877A

Program:

```
void main()
{ TRISB = 0x00;
  PORTB = 0x00;

  while(1)
  { portb.f0 = 0xff;
    delay_ms(400);
    portb.f0 = 0x11;
    portb.f1 = 0xff;
    delay_ms(400)
    portb.f1 = 0x00;
  portb.f2 = 0xff;
  delay_ms(400)
```

Name of Experiment: Write a program to count 0 to 9 in 7 segment display using PIC micro-controller.

Objectives:

① ~~Learning~~ to design a 7 segment display using PIC microcontroller

② ~~Understanding~~ To understand 7 segment display principal

Theory:

Seven segment displays are the output display device that provides a way to display information in the form of image ontext on decimal numbe which is an alternative to the more complex dot matrix display. It is widely used in digital clock basic calculator, electronic meters and other electronics devices that displaying numerical information. It consis of seven segment of light-emiting diode which are assembled like numerical 8.

According to the type of application, there are two types of configuration of seven-segment display.

① Common anode display.
② Common cathod display.

① In common cathode segment displays, all the cathode connection of led segment are connected together to logic 0 or ground. we use logic 1 though a current limiting resistor to forword bias the indidual anode terminal a to g.

② where as the anode connections of the LED segment are connected together to logic in a common anode seven segment display. we use logic though a current limiting resistor to the cathode of a particular segment a to g

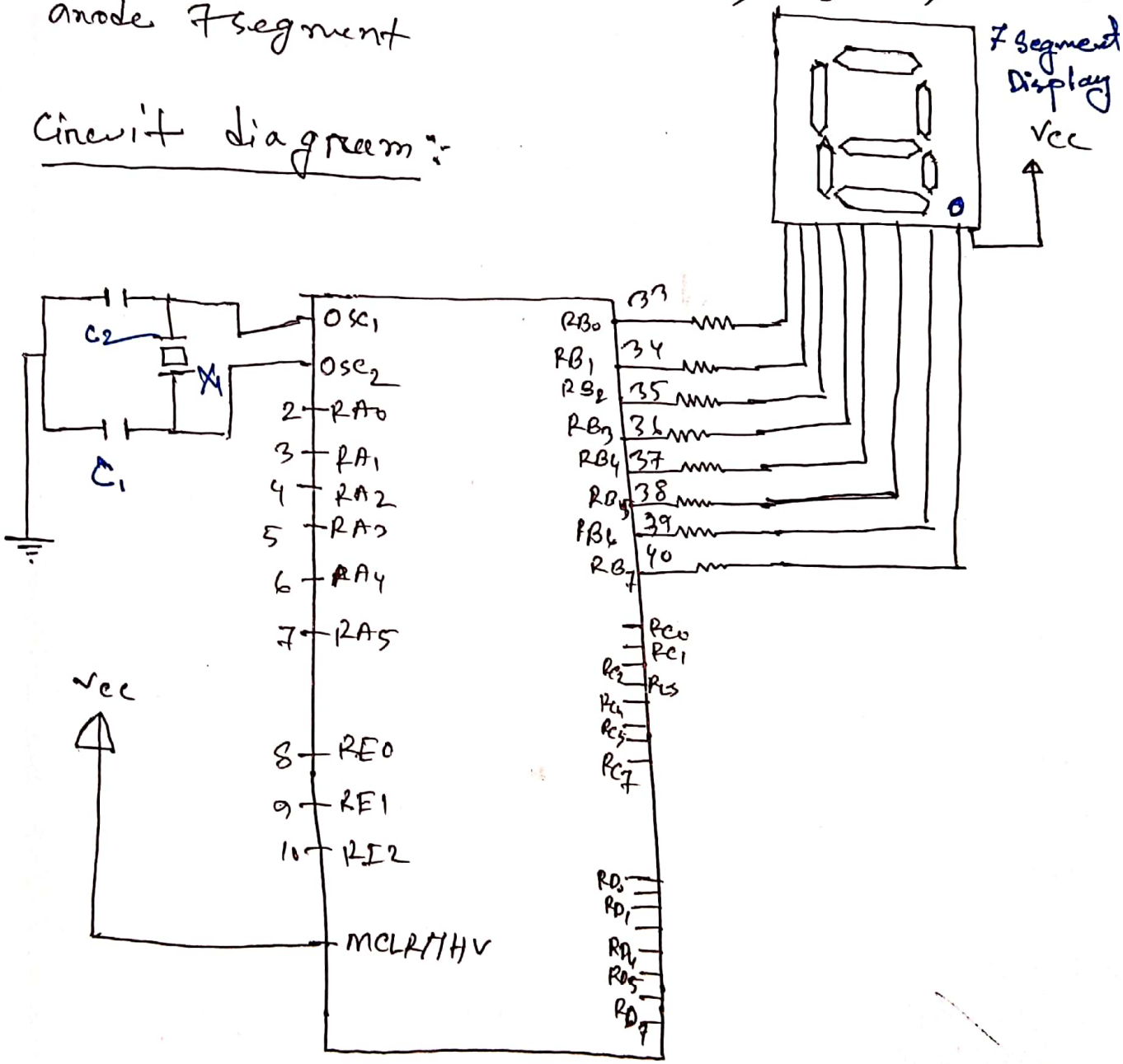
Common anode seven segment display are more popular than cathode seven segment display because logic circuit can sink more current than they can source and it is the same as connecting LEDs is reverse.

Digital clocks, clocks radios, calculator.

Apparatus required:-

PIC 16F877A, capacitor, resistor, crystal, common anode 7segment

Circuit diagram:-



PIC 16F877A

figure Caption?

Code:

```
Void main()
{ int i=0
  char anna[] = {0x90, 0x79, 0x24, 0x30,
   0x19, 0x12, 0x02, 0x78};
TRISB = 0x00;    // Set portb as output
portb = 0xff;    // Comments.
while(1)
  { portb = anna[i];
    delay_ms (500);
      i++;
      if (i==10)
          i=0;
    }
}
```

Name of Experement:- Analog signal input in the microcontroller on display ADC value in the vintual terminal

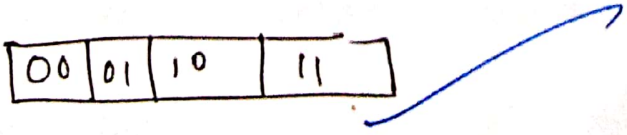
Objectives:

① To design a circuit to read display ADC value in the vintual terminal

② To learn about the display of ADC value in the vintual terminal.

Theory:

The role of ADC converter is to convert analog voltage values to digital values. The ADT converter is to convert analog voltage values to digital values. The ADT converter converts analog voltage to binary number. These binary numbers can be in different length -2, 4, 8, 10 bit. The more bits the binary numbers has, the higher the resolution of the A/D with two bits, we can only display 4 disfferent options



We can show the changes from 0 to 5 volt with 4 levels

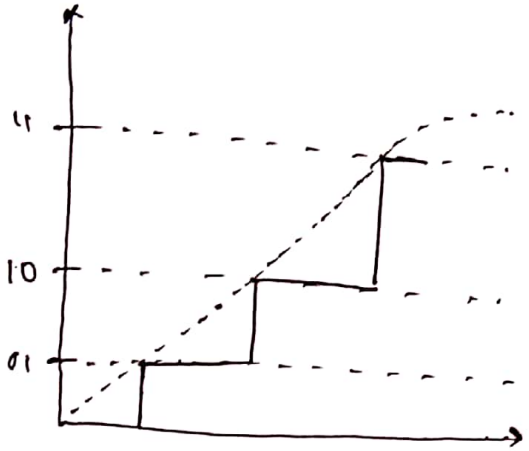


fig: a

We can see from fig-a Vout is not close enough to the original analog input voltage values. Thus we can say that A/D with two binary number of two bits has a low resolution and there is a large gap between the real valve of the analog value of input voltage and the values represented by the A/D. Now let us consider that the voltage that supplied to the A/D converter is still varies from 0 to 5. volts, however the A/D converter converts the input voltage to a binary number of three bits. with three bits we can get 8 different option

000	001	110	011	100	101	110	111

we can see the eight levels in the following illustration

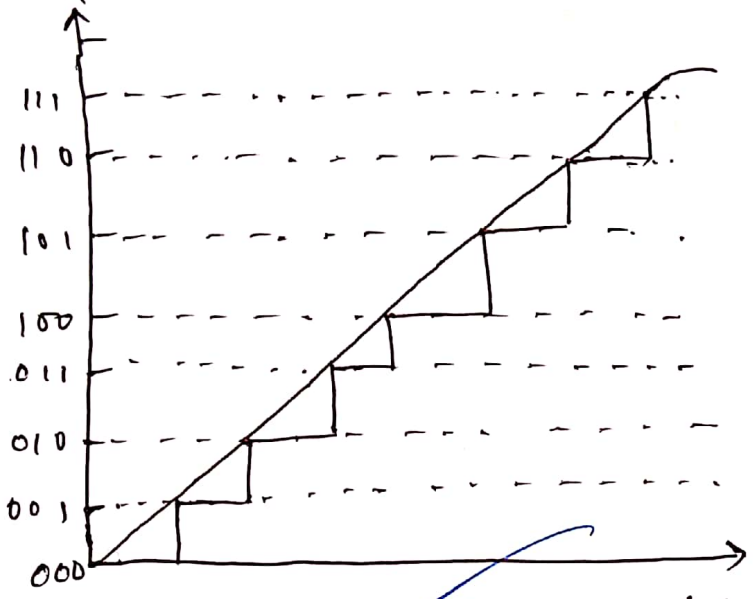


fig :- 6 Display eight levels.

from fig-6, we can see that the gap between the analoge signal and the digital is smaller compared to the previous graph.

Therefore we can see that the A/D of the microcontroller with a large amount of bits has a higher resolution A/D takes less time than the conversion time of the high resolution A/D

The ADCON module located within the

PIC microcontroller has a resolution of ten bit length. Therefore, the converter can devide the analog input voltage between 0 or 0to 5V to $2^{\wedge}10$ levels which 1024 levels. we can say that resolution of this component is very high. we can use the triange method to calculate the binary representation of an analog in voltage.

for example.

let us calculate binary value representation on the analog input voltage of 3.65 voltage

$$\begin{cases} 5\text{volt} \longrightarrow 1024 \\ 3.65V \longrightarrow x \end{cases} \quad x = \frac{1024 * 3.65}{5}$$

$$= 747.52 \approx$$

$$= 748.$$

Circuit Diagram:-

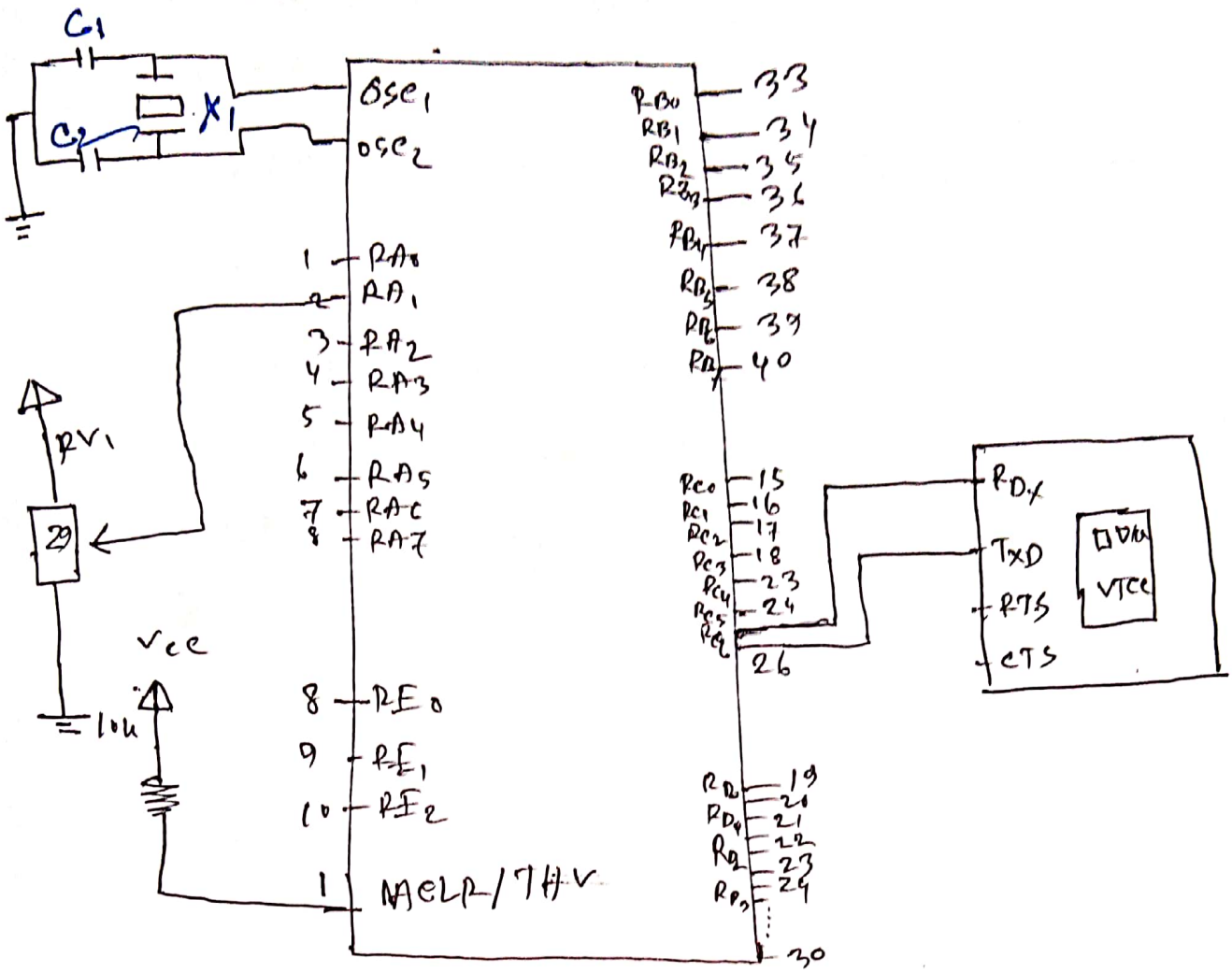


fig:- Displaying ADC value in virtual terminal

Code:

```
int ValADC;
char x[4];
void main()
{ UART1_init(9600);
  ADC_init();
```

```
while(1){
    val ADC = ADC_read(0);
    inttostr(ValADC, x);
    UART1_write_text("Analog value =");
    UART1_write_text(x);
    strcpy(x, " ");
    UART1_write(13);
    Delay_ms(1000);
  }
}
```

Name of the experiment: Write a program to display 2 digit number using 7 segment multiplexing technique.

Objectives:

① ~~Learning how~~ to design a display of 2 digit number using 7 segment multiplexing technique

② ~~Learning~~ To learn & understand and understanding about multiplexing

Theory:

A seven-segment display is a form of electronic display device for displaying decimal numbers that is an alternative to the more complex dot matrix display

Multiplexing technique is used for diving multiple seven segment display the theory of 7 segment display is sample All the similar segment of multiple LED display are connected together and driver through single I/O pin

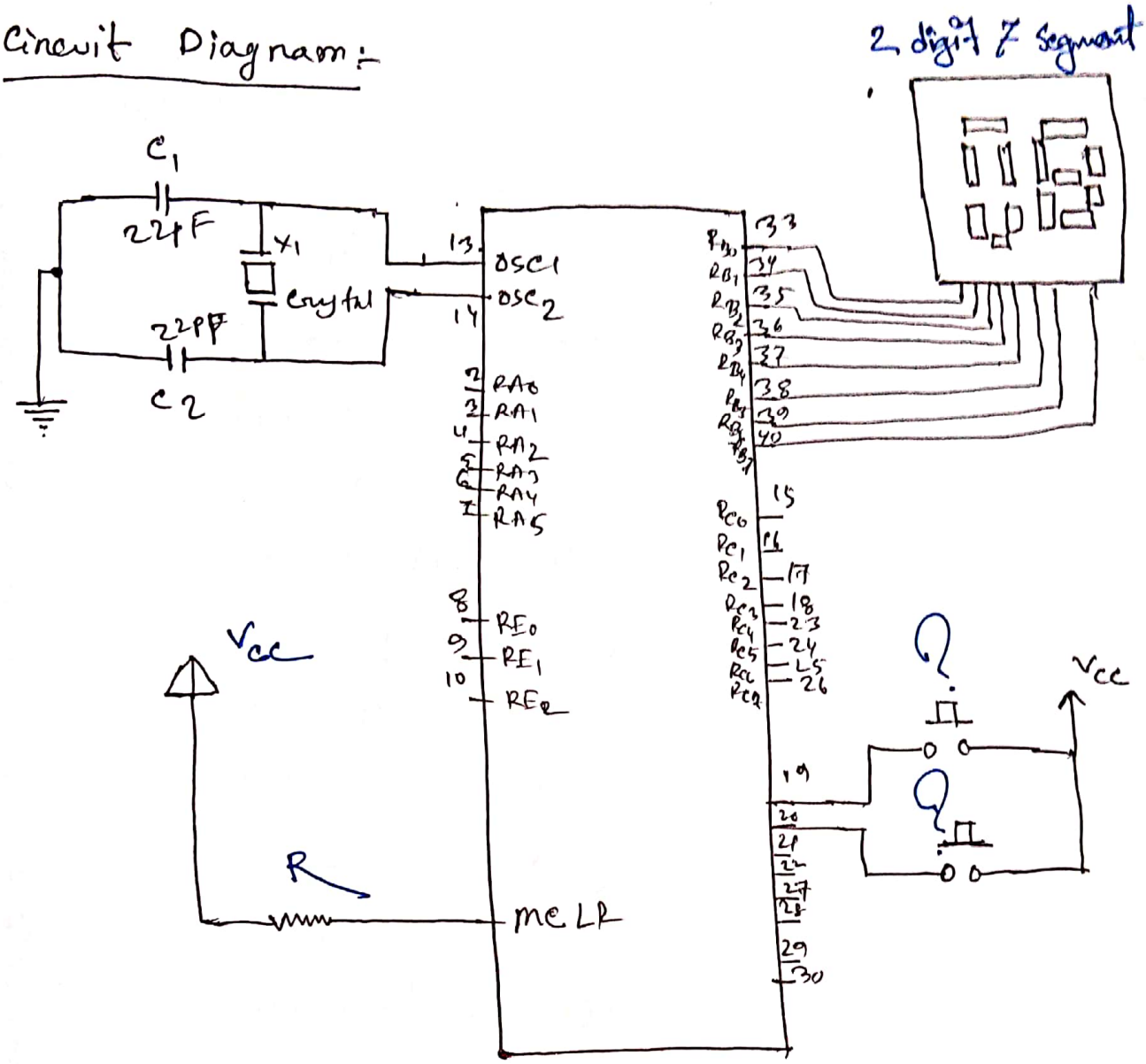
Multiplexing is necessary to interface two or more seven segment display to a micro-controller software program can controll these multiplexed seven segment to ON/Off in a cyclical fashion

This also helps to reduce power in battery operated systems.

Apparatus Required :-

1. PIC16F877A, capacitor, resistor, crystal,
2. button, 2 digit seven segment
3.
4.

Circuit Diagram:-



Micro code:

```
Char segment [] = {0x3F, 0x06, 0x5B,
    0x4F};
int  i=0;
void main(){
        trisb = 0x00;
        trisc = 0x00;

void main(){
    TRISC = 0x00;
    TRISD = 0x00;
```

```
while (1)
{  PORTD = 0x80;
   PORTC = 0x00;
   ms_Delay (10)
   PORTD = 0x40;
   PORTC = 0ff;
   ms_Delay (10)
   PORT D = 0x20;
   portC = 0xff;
   ms Delay (10)
   pont D = 0x10;
   ponte = 0x10;
   ms Delay (10);

   PORTD = 0x08;
   PORTC = 0x18;
   msDelay (10)
   PORTD = 0x02;
   PORTC = 0xff;
   ms Delay (10);

   PORT D = 0x01;
   msdelay (10)
}
}
```

```
portb = 0x00;
portc = 0x00;
trisd = 0xff
portd = 0;
  while (1)
    {  porcf = 0;
       portb = segment [i%10];
       delay_ms(10);
       portc.f0 = 1;
       portb.f1 = 0;
  port = segment [i%10];
   delay_ms (10);
   port.f1 = 1;
    if (portd.f == 1)
      { i++;
        while (portd.f0 == 1);
      }
   if (port.f1 == 1) { i--; while (portd.f1==1)
     {
      if (i<0 || i>09)
          i = 0;
     } }
}
```

Name of the Experiment :- Write a program to interface LED display with push button using pic microcontroller

Objectives:

1. To learn push button interfacing with pic micro controller
2. To learn how to control a led using a push button
3. To design and understand the circuit diagram.

Theory:

The push-button is a basic input device in the embedded system. It is used to control the operation of any output device using the microcontroller or control unit.

It basically breaks the electrical circuit and interrupts the flow of current

The push-button is basic mechanical on-off button that act on control

devices. It short circuit the line when it pressed and opens when it is no pressed.

In circuit pull-up and pull-down use to convert infinite or zero resistance into the digital signal. on the basic of the pull-up and pull-down resistor. we can interface the switch in two way. The value of pull-up and pull down resistance depends on the microcontroller

positive logic:- In this connection, we use a pull-down resistor connected to the ground, when we pressed the switch then logic asserts high and when we disconnect the switch logic assert logic

Negative logic:

In this connection, we use a pull-up connected to Vcc when we pressed the switch then logic assert high

Q2

Apparatus required: pic16F877A, crystal, capacitor, resistor LED

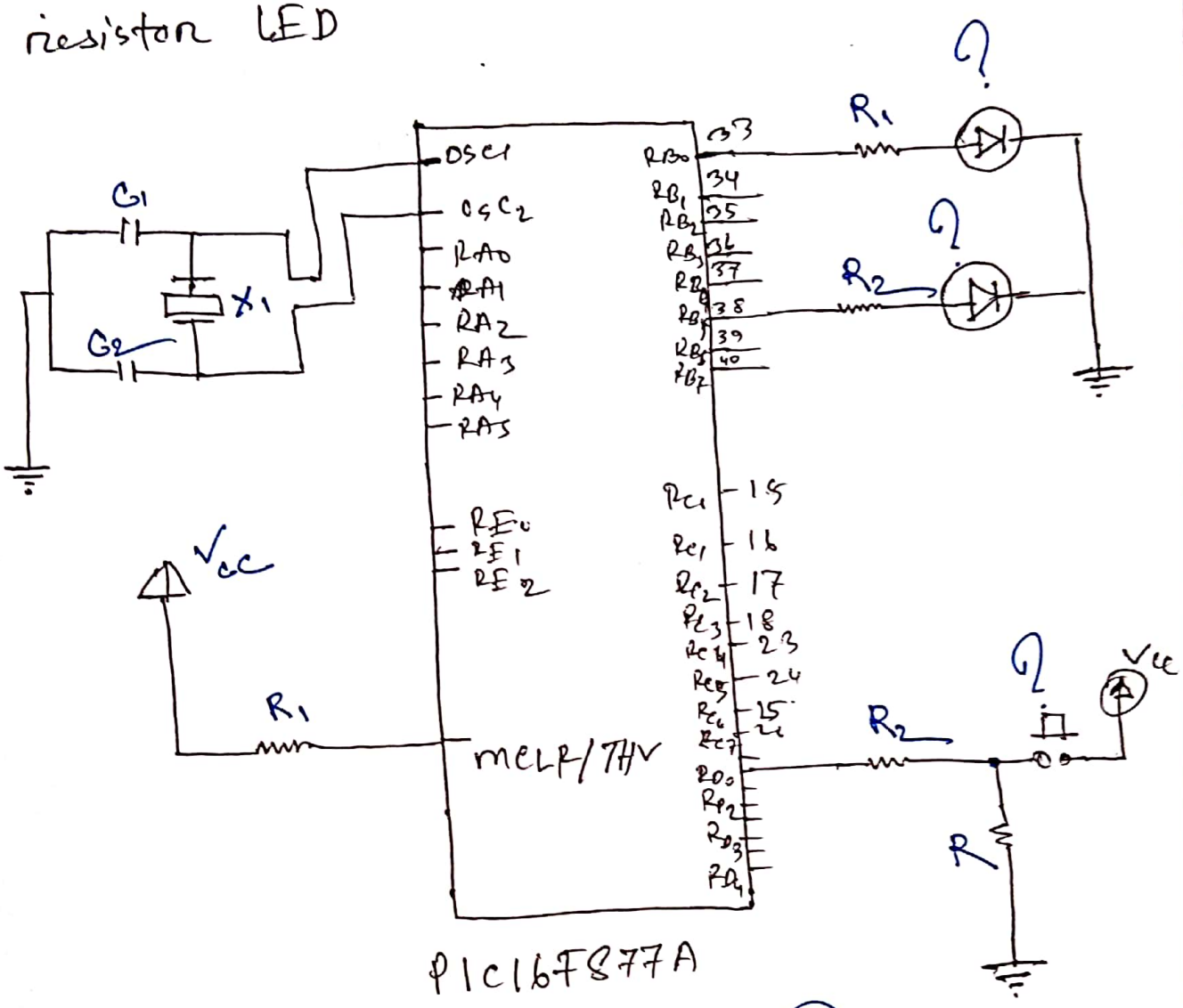


fig: Button interfacing using pic microcontroller

Mikro C program:

```
void main()
{ int count=0;
  TRISD = 0xff;
  TRISB = 0x00;
```

```
portb f0=0;
while (1)
  { if (portd.f0==1)
      delay_ms(200)
    else
      count=1;
  }
  if (count==0)
    { portb.f0=0;
      portb.f5=0;
      delay_ms (200)
    }
  else
    { portb.f0=1;
      portb.f5=1;
      delay_ms (200);
    }
}
```

Name of the experiment:- Dot matrix display interfacing with pic16F877A microcontroller

objects:

① To learn Dot matrix display interfacing with pic16F877A microcontroller

② To learn how to control Dot matrix digram

Theory: A Dot matrix display is a device which contains containing light emiting diodes aligned in the from of matrix. Dot matrix display are used in applications. where symbol, graphic charaters, alphabets number are needed to be displayed in Static ass well as following motion. A typical dot matrix is shown below:-

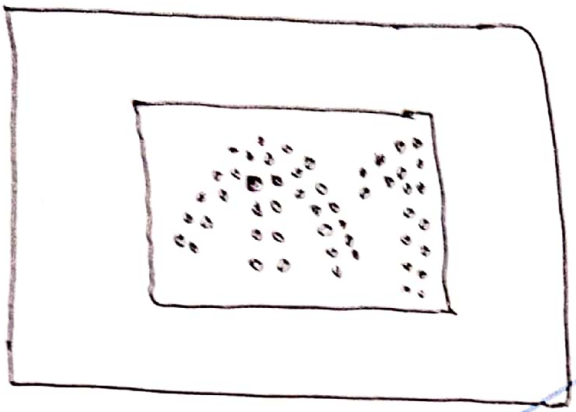
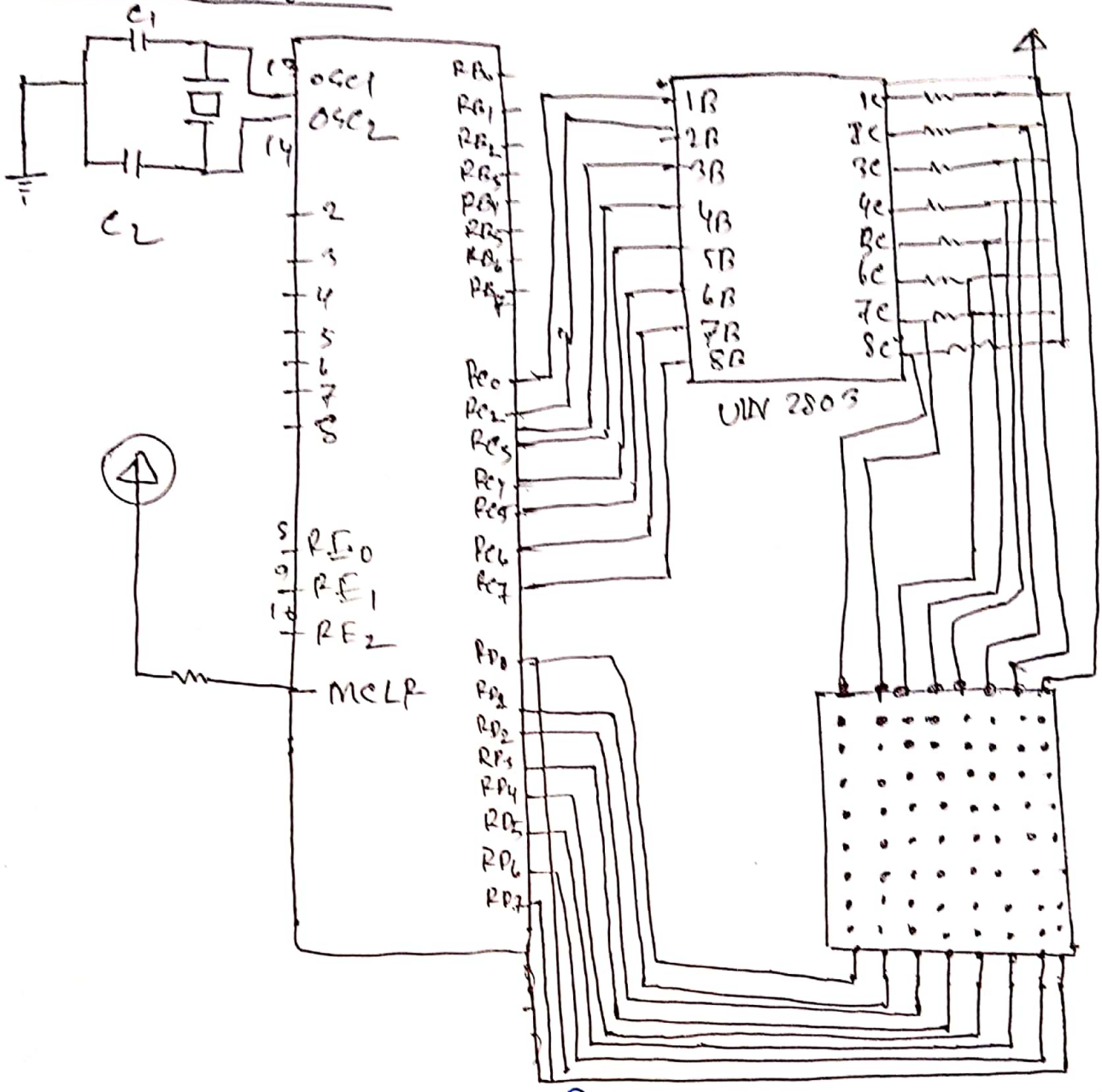


fig:- a A typical dot matrix display is using in lift

Types of dot matrix:

Dot matrix display is manufactured in various dimensions like 5X7, 8X8, 16X8, 32X8, 64X64 and 128X64 where the numbers represents LED's in rows and columns.

Circuit diagram:



Caption?

Micro c code:

```
Void ms delay (unsigned char time)
{
    unsigned char y, x;
    for (y=0; y<time; y++)
        { for (x=0; x<20; x++);
        }
```

Experiment no: 7

Experiment name :- LM35 Temperature Sensor Data Read and display using LCD

objectives:

① To learn about using LCD module

② To learn and understand the circuit diagram of LCD module.

③ To learn interfacing LCD with micro controller

Theory:

To interface LCD with pic microcontroller, we use general purpose input-output pins (GPIO pins). Because we send control and data signal to LCD through these I/O pins

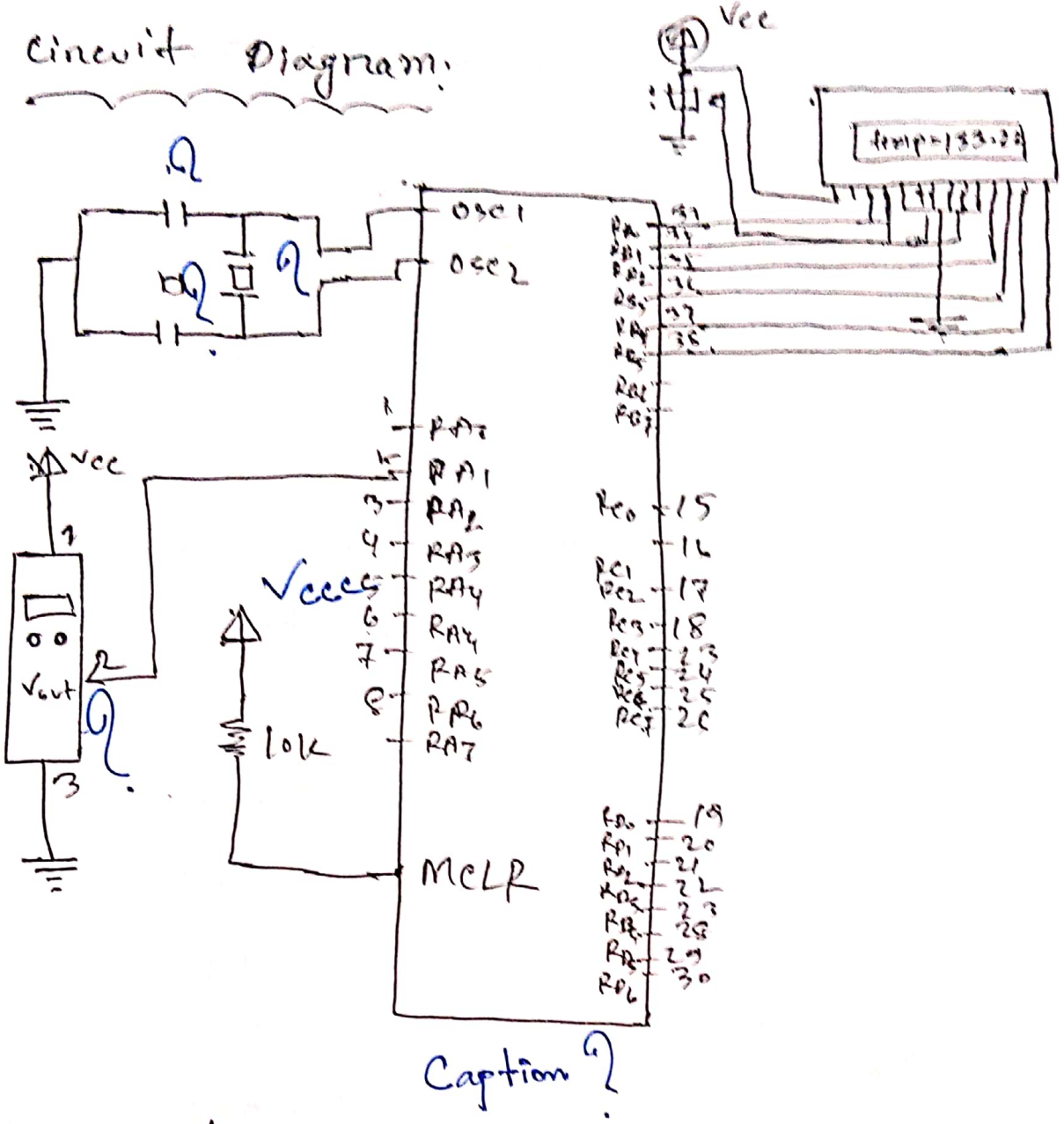
16X2 LCD pinout:

It consist of 14 pins. There are 8 data pins from D_0-D_7 and three control pins such as RS, RW, and E. LED and LED- pins are

LM35 Temperature sensor:-

- LM35 is a temperature measuring device having an analog output voltage proportional to the temperature.
- It provide output voltage in centigrade. It doesnot require any external calibration circuitry
- The sensitivity of LM35 is 10 mv/degree celcius. As temperature output voltage also increases.
- It is a 3-terminal sensor used to measure surrounding temperature ranging from $-55^{\circ}C$ to $150^{\circ}C$
- LM35 gives temperature output which is more precise than mistor output

Circuit Diagram:



Caption ?

Micro code:

```
sbit  LCD-RS  at  RB0-bit;
sbit  LCD-EN  at  RB1-bit;
sbit  LCD-D4  at  RB2-bit;
sbit  LCD-D5  at  RB3-bit;
sbit  LCD-D6  at  RB4-bit;
sbit  LCD-D7  at  RB5-bit;
sbit  LCD_RS-Direction at TRISB1-bit;
sbit  LCD-EN-Direction at TRISB2-bit;
```

```
sbit LCD_RS_direction at TRISB5_bit;
sbit LCD_EN_direction at TRISB6_bit;
sbit LCD_D7_direction at TRISB4_bit;
char display[16] = "  ";
void main() {
    unsigned int result;
    float volt temp;
    trisb = 0x00;
    trisa = 0xff;
    adcon1 = 0x80;
    Lcd_init();
    Lcd_cmd (Lcd_clear);
    Lcd_cmd (LCD_cursor_off);
while(1) {
      result.adc_read (0);
      volt = result * 4.88;
      temp = volt/10;
     LCD_out (1,1, "temp:");
    }
}
```

```
sbit LCD_D5_Direction at TRISB5_bit;
sbit LCD_D6_Direction at TRISB6_bit;
sbit LCD_D7_Direction at TRISB5_bit;
char display[16] = "  ";
void main() {
    unsigned int result;
    float volt temp;
    trisb = 0x00;
    trisa = 0xff;
    adcon1 = 0x80;
    Lcd_init();
    Lcd_cmd (_lcd_clear);
    Lcd_cmd (_LCD_cuson_off);
while(1) {
    result.adc_read (0);
    volt = result * 4.88;
    temp = volt/10;
    LCD_out (1,1, "temp:");
}
}
```

Experiment no: 8

Experiment name: write a program to control a high voltage load using mechanical relay

Objectives:

① To learn how to interface ac load through relay with pic microcontroller

② To design and operate the circuit of relay interfacing

Theory: A relay is an electromagnetic switch is used to switch high voltage/ current using low power circuits, Relay isolates low power circuits from high power circuits. It is activated by energizing a coil wounded on a soft iron core. A relay should not be directly connected to a microcontroller.

Because,

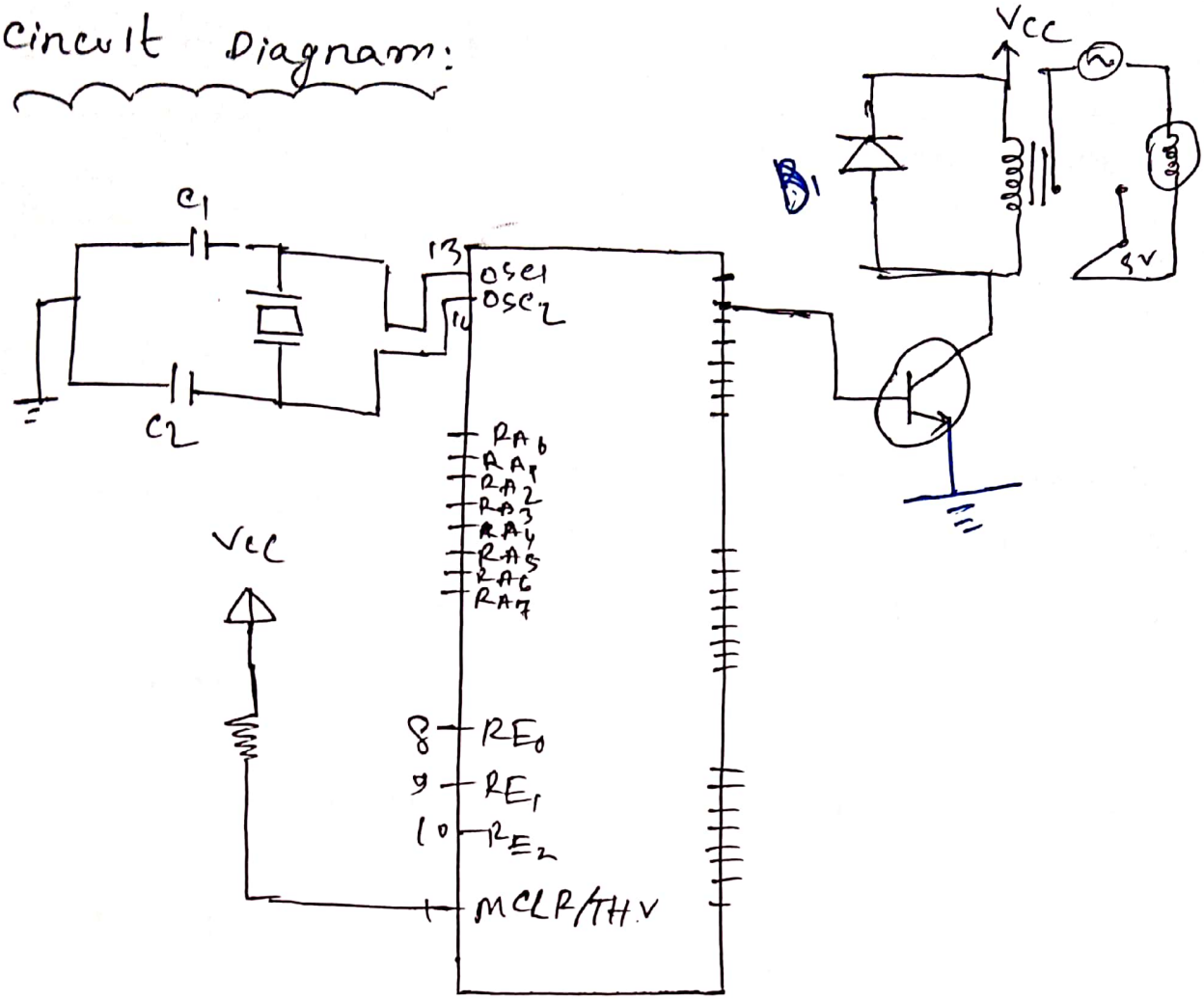
① A microcontroller is not stable to supply current required for the working of relay. Maximum current that a pic Micro-controller handle is 25 mA while a relay needs about 50-100mA current

② A relay is activated by energizing its coil microcontroller may stop working by the negative voltage produced in the relay due to its back end.

Apparatus required:

pic16F877A, Crystal, capacitor, resistor transistor, diode, bulb, relay, ac voltage.

Circuit Diagram:



micro c code:

```
void main()
{ TRISB = 0X00;
  portb = 0x01;
while (1)
{ portb.f1 = 1;
  delay_ms (2000);
  portb.f1 = 0;
  delay_ms (20s)
} }
```

Experiment no:- 9

Experiment name: DC motor speed control using pwm power and microcontroller

objectives:-

① To learn how to control the average power delivered to a load using power and how to control the speed of the DC motor

② To understand the circuit diagram

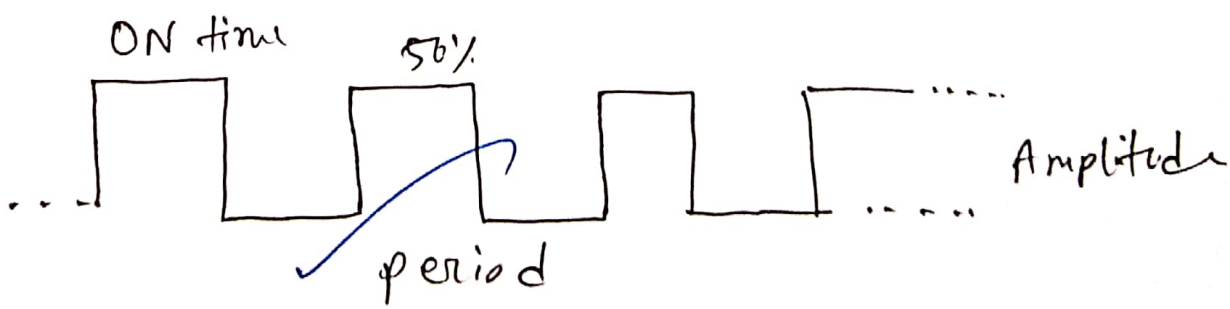
Theory: pwm stands for pulse width modulation. A modulation technique that generates variable width pulse to the percpresend the amplitude of an analog input signal

pwm is a type of signal which can be produced from a digital IC such as micro-controller or 555 timer. The signal thus produced will have a train of pulses and these pulses will be in form of a squre wave. that is, at any given instance of time the wave will either

be high or will be low. the duration of which the signal stays high is called "On time" and the duration at which the signal stays low is called "off time".

Duty cycle of the pwm: A pwm signal stays on for a particular time and stays off for the rest of period. The percentage of time in which the pwm signal remains high is called as duty cycle. If the signal is always on. It is in 100% duty cycle and it is always off then 0%. duty cycle formula:

$$\text{Duty cycle} = \frac{\text{Turn ON time}}{\text{Turn on time} + \text{Turn off time}}$$



By controling the duty cycle from to

100% we can control the "On time" of pwm signal and thus the width of signal

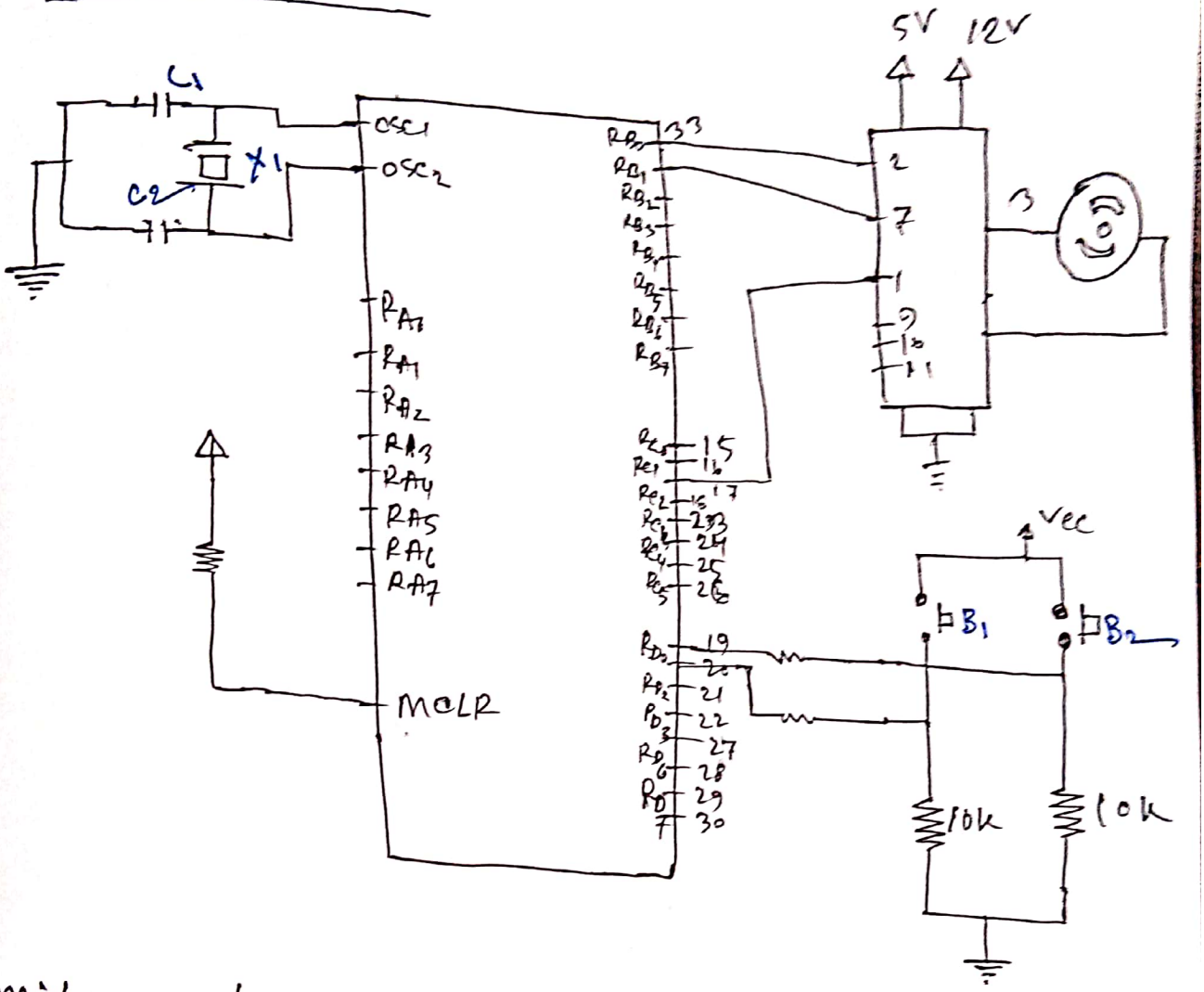
frequency of pwm :-

frequency = 1/ time period

time period = ON time + off time.

Apparatus required :- pic microcontroller, crystal, resistor, capacitor, c2930 IC, DC motor, switch.

Circuit diagram:



Mikon code:

```
void main(){

  Shunt duty = 0;
  TRISD = 0XFF;

  TRISB = 0X00;
  portB.F0 = 0Xff;
  portB.F1 = 0X00;
  pwm1_init(1000);
  pwm2_set_Duty(duty);
```

```
while(1){
  if(RD_bit && duty<250)
  { Relay_ms(100);
    if(RD0_bit && duty<250)
    { duty=duty+10;
      pwm1_set_Duty(duty);
    }
  }
  if(RD1_bit && duty>0)
  {
    Relay_ms(100);
    if(RD1_bit && duty>0)
    {
      pwm1_set_Duty(duty);
    }
  }
}
```

Experiment NO-10

Name of experiment :- Write a program to control servo motor using pic microcontoller

Objectives:

① To design and understand the circuit of servo motor

② To Learn How Learn the interfacing of a servo motor with PIC16F877A servo motor works and microcontroller

③ Programming to control servo motor and hardware connections of servo motor with servo motor with PIC16F877A micro-controller.

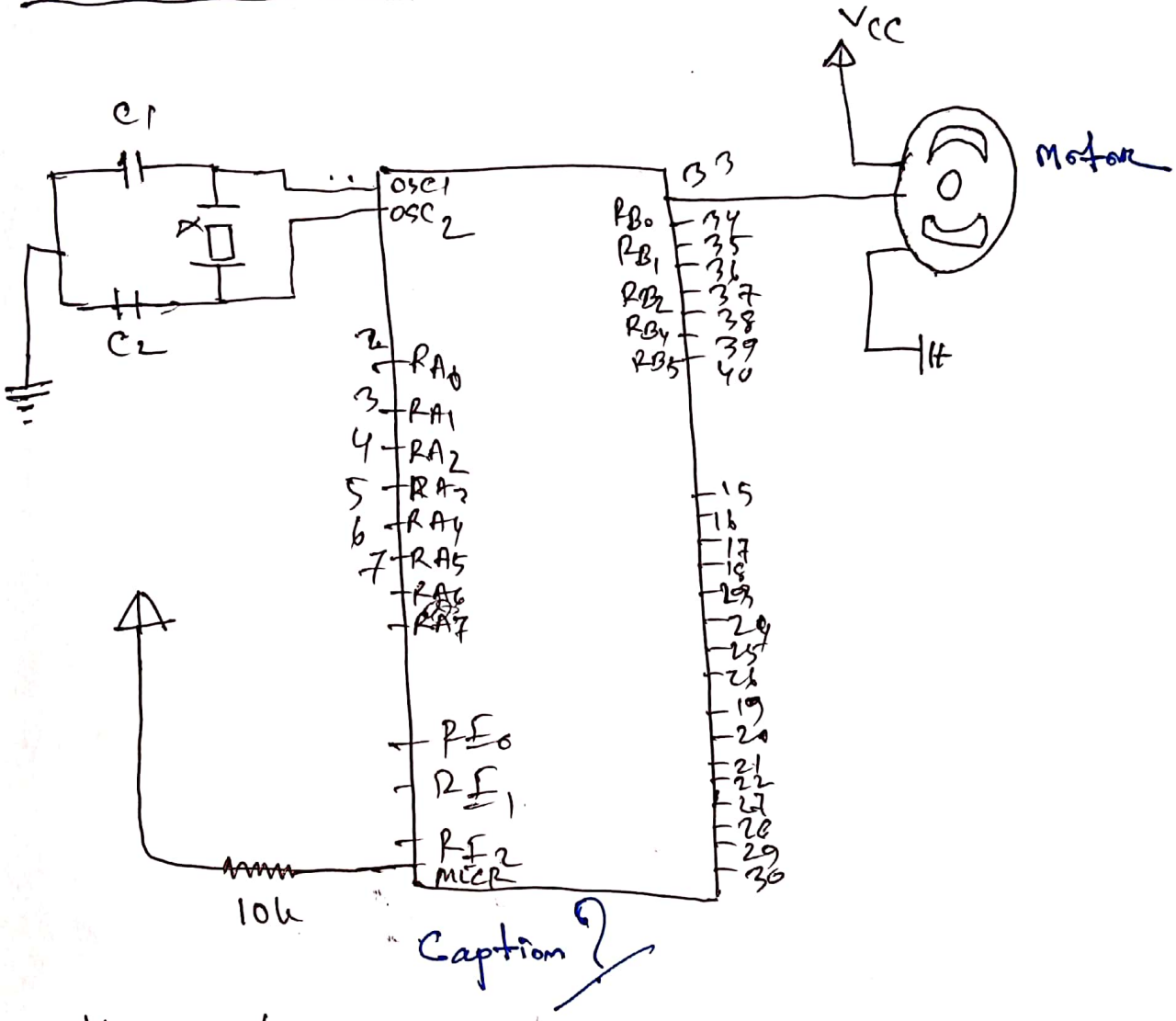
Theory:

A servomotor is a special kind of motor that operates upon the instructions. It provides its angular precision, which means, unlike other electrical motors that keep on rotating until power is applied to them and stops when the

power is switched off, the servo motor rotates only to a certain degree on until it is required to and then the motor stops and waits for the next instruction to carry out further action. Servo motors are controlled with the help of servo-mechanism. Servo motors are used for precise positioning in robotic arms, legs, RC etc. Hobby servo motors have three wires two of them (RED and Black) are used to give control signals. Servo can be easily controlled using microcontroller using PWM signals on the control wire. Here we using a servo whose angulation rotations is limited to 180°. The input to its control line determine the position demanded for the output shaft.

Apparatus required: PIC16F877A, Crystal, Capacitor, resistor, servo motor.

Circuit Diagram:



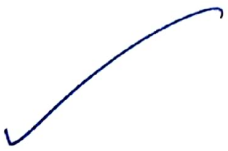
Caption

Mikro code:

```
void ServoRotate()
{
  unsigned int i;
  for (i=0; i<50; i++)
  {
  portB.F0=1
  Delay_us(800);
  portB.F0=0;
```

```
Delay_us (9200);
}
void ServoRotate_90()
{
    unsigned int i;
  for(i=0; i<57; i++)
    { portB.f0 = 1;
      Delay_ms(1500);
      PortB.f0=0;
       Delay_us(18500);
    }
}
void Servo Rotate180()
{
    unsigned int i;
     for(i=0; i<50; i++)
       { portB. F0=1;
        Delay_us(2200);
        port.B.f0 =0;
        Delay_us(17800);
       }
}
```

```
void main()
{ TRISB = 0;
  do { Servo Rotate ();
       Delay_ms (2000);
       Serval Rotate 90();
       Delay_ms (2000);
       Servo Rotate 180();
     } while(1);
~~while(1)~~
}
```



Experiment no:— 11

name of the experiment: write a program for Interfacing stepper motor with pic microcontroller.

Objectives:—

1) to describe and explain to operation of a stepper motor.

2) to design a steper motor with PIC16F887A and understand its circuit diagram.

Theory: A stepper motor is a brushless, synchronous dc electric motor, which divides the rotation into a number of equal steps. It finds great application in field of microcontroller such as robotics. unipolar motor is the most popular stepper motor among electronics hobbyist because of its ease of operation and availability.

stepper motor can be easily interfaced with pic microcontroller by using readymade ics such as L293D or ULN2003.

We have three different types of stepping mode for unipolar stepper motor.

Wave drive: In this mode only one stator electromagnet is energised at a time. It has the same numbers of steps as the full step drive but the torque is significantly less. It is rarely used. It can be used where power consumption is more important than torque.

Wave drive stepping sequence:

Step	A	B	C	D
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1

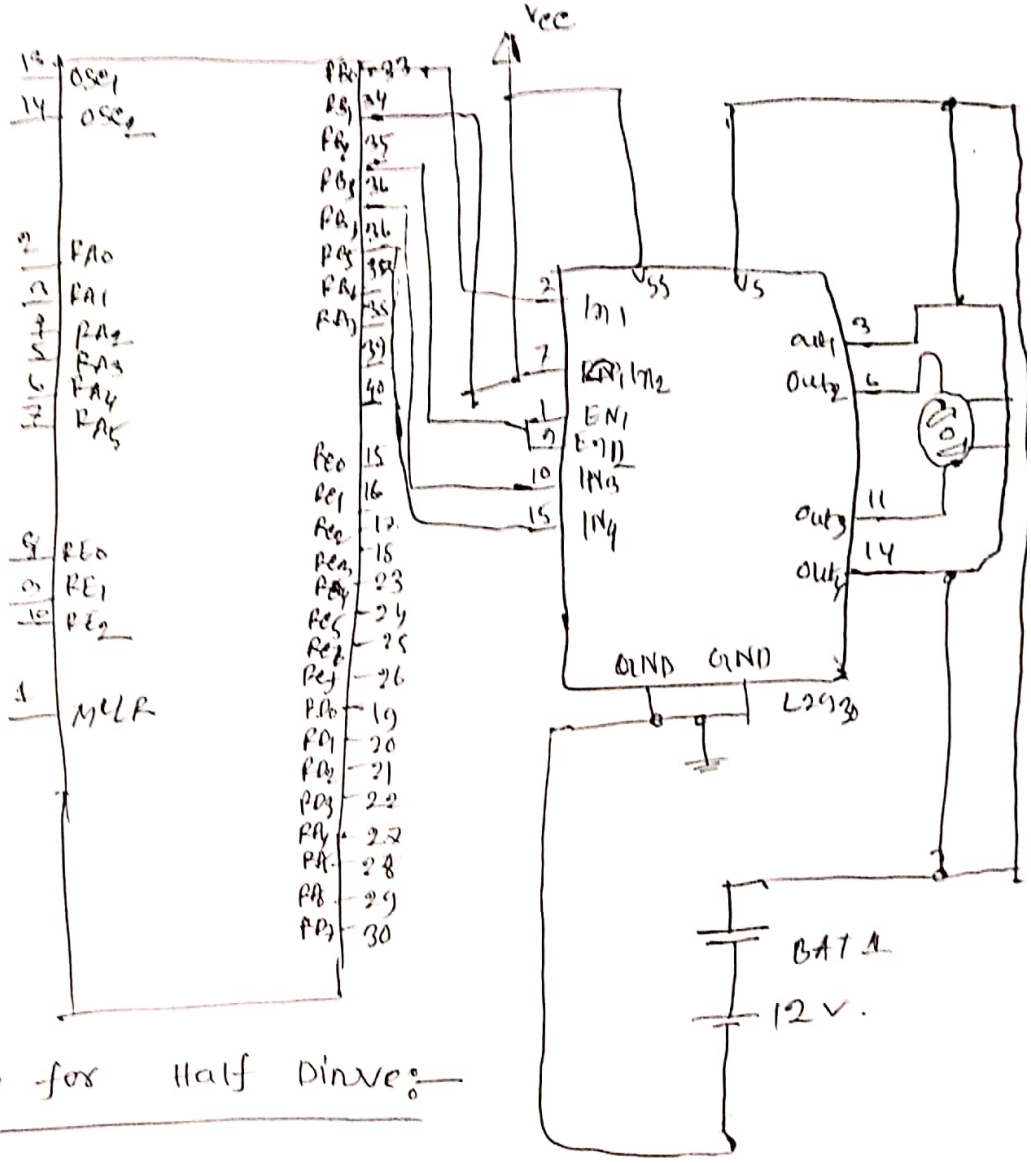
Full drive: In this mode, two stator electromagnets energised at a time.
It is the usual method used for driving and the motor will run at its full torque. in this mode of driving.

Full drive stepping sequence:

step	A	B	C	D
1	1	1	0	0
2	0	1	1	0
3	0	0	1	1
4	1	0	0	1

Apparatus requirment:-
PIC16F877A, crystal, capacitor, resistor, stepper motor, Battary, L293D.

circuit diagram:-



Mikroc code for Half Dirve:-

```
void main()
{  CMCON  = 0x07;
   ADCON1 = 0x06;
  TRISB  = 0;
  PORTB  = 0x0F;

do { PORT B = 0b00000001;
     Relay_ms (500);
```

```
PORTB = 0b00000011;
delay_ms(500)
PORTB = 0b00000010;
delay_ms(500)
PORTB = 0b00000100
delay_ms(500)
portB = 0b00001100;
Delay_ms(500);
portB = 0b00001000;
delay_ms(500);
portB = 0b00001001;
Delay_ms(500);
{ while(1);
  {
```