```c
#include<reg51.h>

#include<stdio.h>

#include<math.h>


#define dataport P1


sbit cap1=P0^0;

sbit cap2=P0^1;

sbit cap3=P0^2;

sbit cap4=P0^3;


sbit relay=P0^4;


sbit autoled=P0^5;

sbit manualled=P2^0;


sbit clsw=P0^6;

sbit amsw=P0^7;


char array[10];

//char array1[16];


void TOM1Delay(void);
```

```c
sbit rs=P2^3;

sbit rw=P2^2;

sbit en=P2^1;


sbit sw1=P2^4;

sbit sw2=P2^5;

sbit sw3=P2^6;

sbit sw4=P2^7;


sbit white=P3^2;

sbit black=P3^3;


void delay_ms(unsigned int count)
{
        unsigned int i,j;
        for(i=0;i<=count;i++)
        {
                for(j=0;j<=56;j++);
        }
}
void lcdcmd(unsigned char cmd)          // send command to LCD
{
        dataport=cmd;
        rs=0,en=1;
        delay_ms(2),
```

```c
        en=0;

}

void lcddata(unsigned char item)          //send data to LCD

{

        dataport=item;

        rs=1,en=1;

        delay_ms(2),en=0;

}

void lcd_init()                //LCD initialize

{

        lcdcmd(0x38);

        lcdcmd(0x06);

        lcdcmd(0x0c);

        lcdcmd(0x01);

}

void lcd_string(unsigned char *text,unsigned int loc)

{

        int i;

        lcdcmd(loc);

        delay_ms(500);

        for(i=0;text[i]!='\0';i++)

        {

                lcddata(text[i]);

        }

}
```

```c
void TOM1Delay(void)

{

TMOD=0X01;

TL0=0XFD;

TH0=0X4B;

TR0=1;

while(TF0==0);

TR0=0;

TF0=0;

}



void main(void)

{

  int a=0, b=0;

  float c=0, cd=0, d=0, e=0, f=0, pf=0, pf1=0, pf2=0, ipf=0;

        rw=0;

        relay=0;


         lcd_init();

        lcd_string("POWER FACTOR ", 0x80);

        lcd_string("CONTROLLER   ", 0xC0);


    TMOD=0X01;
```

```c
TL0=0X00;

TH0=0X00;


        cap1=0;                 //relay1 on

        cap2=0;                 //relay2 off

        cap3=0;

        cap4=0;

        lcdcmd(0x01);


    while(1)
    {

      //AUTO MODE //
            if(amsw==1)
            {           autoled=1;

                        manualled=0;

                    TL0=0X00;

                TH0=0X00;

                    while(white==1);

                while(white==0);


                    TR0=1;


                    while(black==0);

                    TR0=0;
```

```c
a=TL0;

b=TH0;


c=b*256;

d=c+a;


d=d*1.085;

d=d/1000;



if(d<5)

{


e=d*18*0.017453292;


pf=cos(e);


sprintf(array,"%.2f msec",d);

lcd_string("I LAGS=", 0x80);

lcd_string(array, 0x87);


sprintf(array,"%.2f",pf);

lcd_string("PF=------", 0xC0);

lcd_string(array, 0xC3);
```

```c
if(d<1)

    {

    lcd_string("OFF CAPACITORS ", 0xC9);

                cap1=0;                  //relay1 off

                    cap2=0;        //relay2 off

                    cap3=0;

                    cap4=0;


    }
    else if(d<2)

    {


                    cap1=1;                  //relay1 on

                    cap2=0;                  //relay2 off

                    cap3=0;

                    cap4=0;

                    lcd_string("ONE capacitor ON       ", 0xC9);
    }
    else if(d<3)

    {
;

        cap1=1;            //relay1 on

                    cap2=1;                    //relay2 on

                    cap3=0;

                    cap4=0;
```

```c
            lcd_string("TWO capacitor ON  ", 0xC9);

            }

            else if(d<4)

            {
;

                cap1=1;              //relay1 on

                        cap2=1;                    //relay2 on

                        cap3=1;

                        cap4=0;

            lcd_string("THREE capacitor ON  ", 0xC9);

            }

             else if(d<5)

            {
;

                cap1=1;              //relay1 on

                        cap2=1;                    //relay2 on

                        cap3=1;

                        cap4=1;

            lcd_string("FOUR capacitor ON  ", 0xC9);

            }


            }


            else

            {

                    cap1=0;              //relay1 off
```

```c
            cap2=0;          //relay2 off

            cap3=0;

            cap4=0;



            cd=10-d;



             e=cd*18*0.017453292;


pf=cos(e);


 sprintf(array,"%.2f msec",cd);

 lcd_string("I LEADS=", 0x80);

 lcd_string(array, 0x88);


 sprintf(array,"%.2f",pf);

 lcd_string("PF=------", 0xC0);

 lcd_string(array, 0xC3);




 }


 if(clsw==0)

 {

relay=0;
```

```c
                }
                else
                {
                relay=1;
                }
}


// MANUAL MODE //
else
{
                autoled=0;
                manualled=1;
     TL0=0X00;
         TH0=0X00;
                while(white==1);
         while(white==0);


                TR0=1;


                                TR0=0;


                a=TL0;
                b=TH0;


                c=b*256;
```

```
            d=c+a;


    d=d*1.085;

        d=d/1000;




                pf=cos(e);






        if(sw1==0)

        {cap1=1;

        }

         else

        {cap1=0;

        }


         if(sw2==0)

        {cap2=1;

        }

         else

        {cap2=0;

        }
```

```c
  if(sw3==0)
{cap3=1;
}
 else
{cap3=0;
}


 if(sw4==0)
{cap4=1;
}
 else
{cap4=0;
}



if(d<5)
{

        sprintf(array,"%.2f msec",d);
                                lcd_string("I LAGS=", 0x80);
                                lcd_string(array, 0x87);
                                sprintf(array,"%.2f",pf);
                                lcd_string("PF = ----------- ", 0xC0);
                                lcd_string(array, 0xC5);
```

```c
if(clsw==0)
        {
                relay=0;                //lagging

                pf1=pf;
        }
        else
        {

                relay=1;                    //compensated
                delay_ms(2000);
                pf2=pf;
ipf=pf2-pf1;
                sprintf(array,"%.2f",ipf);

if(pf1>0)
                {
                lcdcmd(0x01);
                lcd_string("IMPROOVED PF =", 0x80);
                lcd_string(array, 0xC0);
                }
                else
                {
                        lcdcmd(0x01);
```

```c
                        lcd_string("plese measure PF", 0x80);

                        lcd_string("in lagging mode", 0xC0);

                    }


                delay_ms(2000);

                lcdcmd(0x01);



            }



        }



        else

        {               cd=10-d;


                    e=cd*18*0.017453292;


pf=cos(e);


                        sprintf(array,"%.2f msec",cd);

                        lcd_string("I LEADS=", 0x80);

                        lcd_string(array, 0x88);

                        sprintf(array,"%.2f",pf);

                        lcd_string("PF = ", 0xC0);

                        lcd_string(array, 0xC5);
```

```c
if(clsw==0)
        {
                relay=0;                    //lagging

                pf1=pf;
        }
        else
        {
                relay=1;

                delay_ms(2000);
                pf2=pf;

                sprintf(array,"%.2f",ipf);

if(pf1>0)
                {
                lcdcmd(0x01);
                lcd_string("IMPROOVED PF =", 0x80);
                lcd_string(array, 0xC0);
                }
                else
                {
                        lcdcmd(0x01);
                        lcd_string("plese measure PF", 0x80);
```

```c
            lcd_string("in lagging mode", 0xC0);
        }



lcdcmd(0x01);



                }



            }



        }



  }


}
```