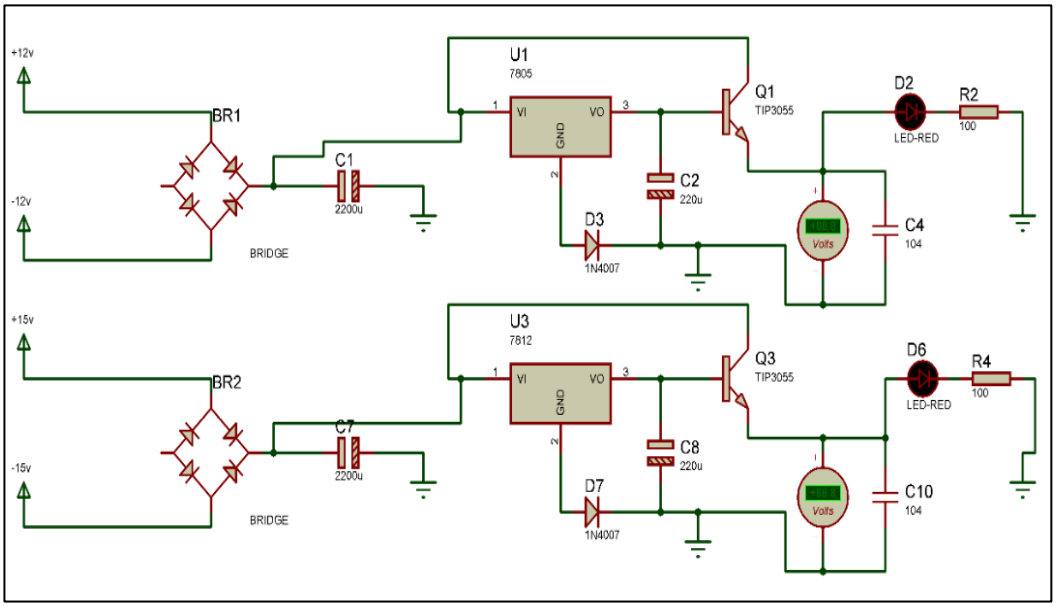
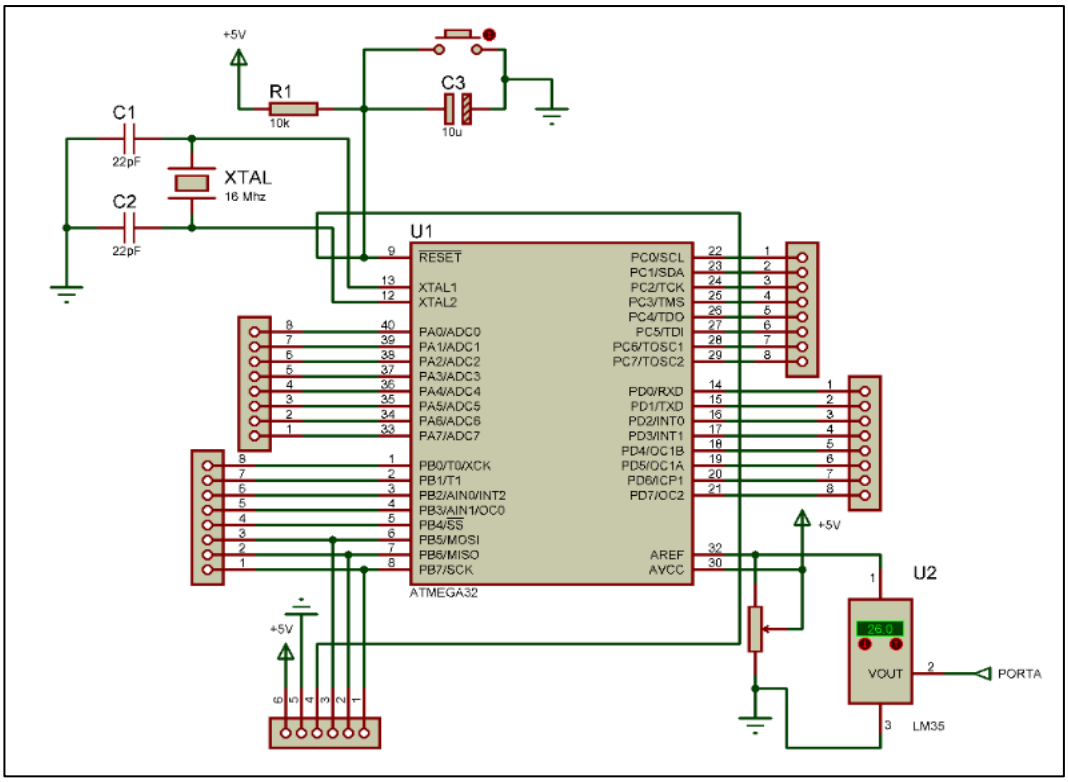
LAMPIRAN

RANGKAIAN KESELURUHAN ALAT

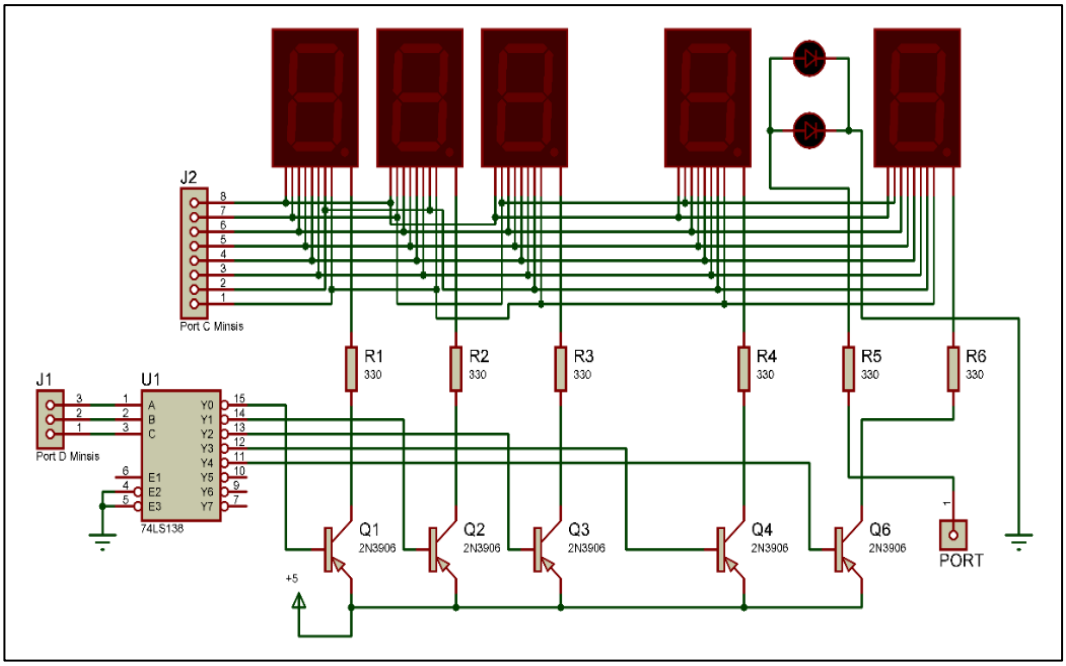
1. *Power Supply*



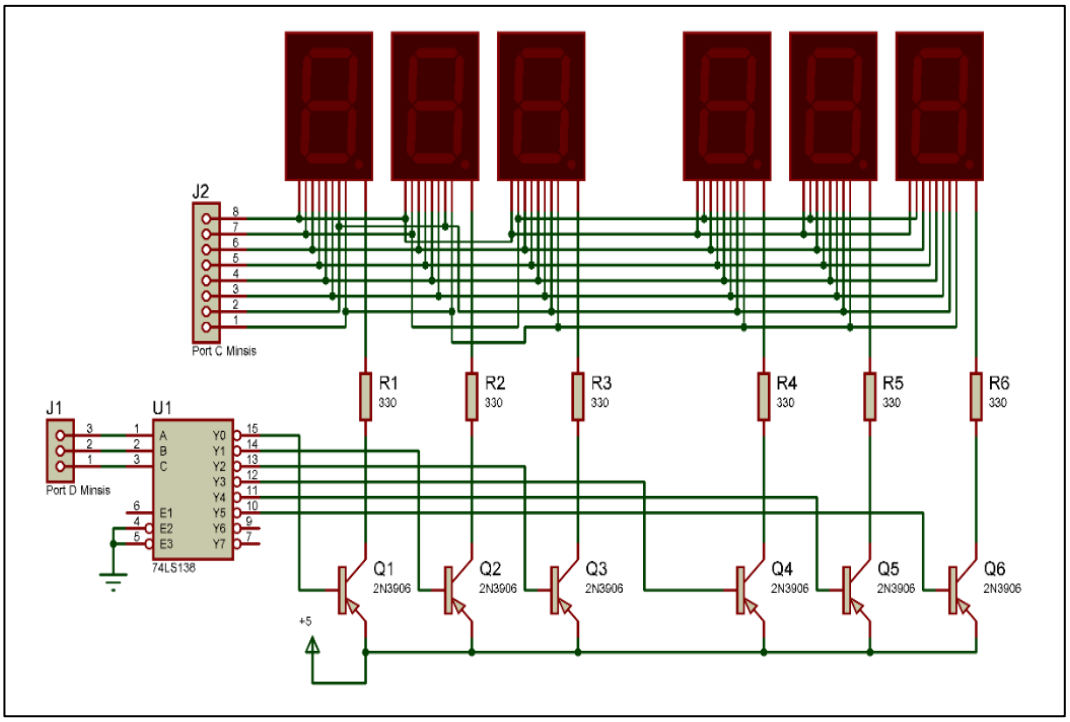
2. Minimum Sistem



3. *Display 7Segment* Suhu *Skin* dan *Timer*



4. *Display 7Segment* Suhu Ruang *Infant Warmer*



PERHITUNGAN ANALISIS DATA

1. Pengukuran Penyinaran Fototerapi Selama 1 Jam

a. Rata – Rata Modul *Timer*

$(\overline{X}) = \Sigma \frac{Xn}{n}$

$= \frac{(X_1 + X_2 + X_3 \ldots\ldots X_n)}{n}$

=(59,59+59,59+59,58+59,59+59,58+59,59+59,58+59,58+59,59+59,59+59,59+59,59+59,58+59,59+59,58+59,59+59,59+59,58+59,59+59,58) / 20

= 59,59 Menit

b. *Error* (%)

Error (%) $= \frac{data\ setting - rerata}{data\ setting}$ x 100%

$= \frac{60,00 - 59,59}{60,00}$ x 100%

Error (%) = 0,7 %

2. Pengukuran Penyinaran Fototerapi Selama 2 Jam

a. Rata – Rata Modul *Timer*

$(\overline{X}) = \Sigma \frac{Xn}{n}$

$= \frac{(X_1 + X_2 + X_3 \ldots\ldots X_n)}{n}$

=(119,59+119,58+119,58+119,59+119,59+119,59+119,58+119,58+119,69+119,59+119,58+119,59+119,59+119,58+119,59+119,58+119,59+119,59+119,59+119,58) / 20

= 119,58 Menit

b. *Error* (%)

Error (%) $= \frac{data\ setting - rerata}{data\ setting}$ x 100%

$= \frac{120,00 - 119,58}{120,00}$ x 100%

Error (%) = 0,4 %

3. Pengukuran Penyinaran Fototerapi Selama 3 Jam

a. Rata – Rata Modul *Timer*

$(\overline{X}) = \Sigma\frac{Xn}{n}$

$= \frac{(X_1 + X_2 + X_3 \ldots\ldots X_n)}{n}$

=(179,58+179,59+179,59+179,58+179,59+179,59+179,59+179,58+179,58+179,59+179,58+179,59+179,59+179,59+179,58+179,59+179,59+179,59+179,58+179,58) / 20

= 179,59 Menit

b. *Error* (%)

Error (%) $= \frac{data\ setting - rerata}{data\ setting}$ x 100%

$= \frac{180,00 - 179,59}{180,00}$ x 100%

Error (%) = 0,2 %

4. Pengukuran Nilai Suhu *Skin* dengan Alat Pembanding

a. Rata – Rata Modul Suhu *Skin*

$(\overline{X}) = \Sigma\frac{Xn}{n}$

$= \frac{(X_1 + X_2 + X_3 \ldots\ldots X_n)}{n}$

=(35,8+35,9+35,9+35,7+35,9+36,0+36,0+36,1+36,1+36,0) / 10

= 35,94 ℃

b. Rata - rata Alat Pembanding (Digital Termometer)

$(\overline{X}) = \Sigma\frac{Xn}{n}$

$= \frac{(X_1 + X_2 + X_3 \ldots\ldots X_n)}{n}$

=(35,9+35,9+36,0+35,9+36,0+36,0+36,1+35,9+36,1+36,0) / 10

= 35,98 ℃

c. Simpangan (Selisih)

Simpangan = (rerata pembanding- rerata modul)

= 35,98 – 35,94

= 0,08 ℃

d. *Error* (%)

Error (%) $= \frac{(rerata\ pembanding - rerata\ modul)}{rerata\ pembanding} \text{x } 100\%$

$= \frac{35{,}98 - 35{,}94}{35{,}98} \text{x } 100\%$

Error (%) = 0,04 %

LISTING PROGRAM

```
/*****************************************************
This program was produced by the
CodeWizardAVR V2.05.0 Professional
Automatic Program Generator
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http://www.hpinfotech.com

Project :
Version :
Date    : 15/07/2018
Author  :
Company :
Comments:


Chip type           : ATmega16
Program type        : Application
AVR Core Clock frequency: 16,000000 MHz
Memory model        : Small
External RAM size   : 0
Data Stack size     : 256
*****************************************************/

#include <mega16.h>
#include <delay.h>

unsigned char
angka[10]={0xc0,0xf9,0xa4,0xb0,0x99,0x92,0x82,0xf8,0x80,0x90};
int satuan,puluhan,koma,data_temp,x,a,detik,menit,b,jam;
float data,suhu,suhu1,suhu2,suhu3,suhu4,suhu5,data2;
unsigned char detiksat,detikpul,menitsat,menitpul,jamsat,jampul;
bit titik;

// Timer1 overflow interrupt service routine
interrupt [TIM1_OVF] void timer1_ovf_isr(void)
{
// Reinitialize Timer1 value
TCNT1H=0xBDC >> 8;
TCNT1L=0xBDC & 0xff;
// Place your code here
 if (PINA.5==0)
 {
  if (b==1)
  {
   detik++;
```

```
  if (titik==1)
  {
   PORTA.3=0x00;
   titik=0;
  }
  else
  {
   PORTA.3=0xff;
   titik=1;
  }
 }

if (b==2)
{
 detik++;
 if (titik==1)
 {
  PORTA.3=0x00;
  titik=0;
 }
 else
 {
  PORTA.3=0xff;
  titik=1;
 }
}

if (b==4)
{
 detik++;
 if (titik==1)
 {
  PORTA.3=0x00;
  titik=0;
 }
 else
 {
  PORTA.3=0xff;
  titik=1;
 }
}

if(detik==60)
{
 detik=0;
 menit++;
```

```
 }
 if(menit==60)
 {
  menit=0;
  jam++;
 }
 if(jam==24)
 {
  jam=0;
  detik++;
 }
}
}

#define ADC_VREF_TYPE 0x40

// Read the AD conversion result
unsigned int read_adc(unsigned char adc_input)
{
ADMUX=adc_input | (ADC_VREF_TYPE & 0xff);
// Delay needed for the stabilization of the ADC input voltage
delay_us(10);
// Start the AD conversion
ADCSRA|=0x40;
// Wait for the AD conversion to complete
while ((ADCSRA & 0x10)==0);
ADCSRA|=0x10;
return ADCW;
}

// Declare your global variables here
void ambil_data()
{
suhu1=suhu*10;
koma=(int)suhu1;
koma=koma%10;
data_temp=(int)suhu;
satuan=data_temp%10;
puluhan=(data_temp/10)%10;
}

void ambil_data2()
{
suhu3=suhu2*10;
koma=(int)suhu3;
koma=koma%10;
```

```
data_temp=(int)suhu2;
satuan=data_temp%10;
puluhan=(data_temp/10)%10;
}

void ambil_data3()
{
suhu4=suhu5*10;
koma=(int)suhu4;
koma=koma%10;
data_temp=(int)suhu5;
satuan=data_temp%10;
puluhan=(data_temp/10)%10;
}

void ambil_data4()
{
   detiksat=detik%10;
   detikpul=(detik/10)%10;
}
void ambil_data5()
{
   menitsat=menit%10;
   menitpul=(menit/10)%10;
}
void ambil_data6()
{
   jamsat=jam%10;
   jampul=(jam/10)%10;
}

void tampilkan_seven_segment()
{
PORTD.2=1;PORTD.3=0;PORTD.4=0;
 PORTC=angka[satuan];
PORTC.7=0;
delay_ms(1);

PORTD.2=0;PORTD.3=0;PORTD.4=0;
PORTC=angka[puluhan];
delay_ms(1);

PORTD.2=0;PORTD.3=1;PORTD.4=0;
PORTC=angka[koma];
delay_ms(1);
```

```
}

void tampilkan_seven_segment2()
{
PORTD.2=0;PORTD.3=0;PORTD.4=1;
PORTC=angka[satuan];
PORTC.7=0;
delay_ms(1);

PORTD.2=1;PORTD.3=1;PORTD.4=0;
PORTC=angka[puluhan];
delay_ms(1);

PORTD.2=1;PORTD.3=0;PORTD.4=1;
PORTC=angka[koma];
delay_ms(1);

PORTD.2=1;PORTD.3=1;PORTD.4=1;
PORTC=angka[koma];
delay_ms(1);
}

void tampilkan_seven_segment3()
{
PORTD.5=0;PORTD.6=0;PORTD.7=0;
PORTC=angka[puluhan];
delay_ms(1);

PORTD.5=0;PORTD.6=0;PORTD.7=1;
PORTC=angka[satuan];
PORTC.7=0;
delay_ms(1);

PORTD.5=0;PORTD.6=1;PORTD.7=0;
PORTC=angka[koma];
delay_ms(1);

PORTD.5=1;PORTD.6=1;PORTD.7=1;
PORTC=0b10100100;
delay_ms(1);
}

void tampil4()
{
   PORTD.5=1;
   PORTD.6=0;
```

```
    PORTD.7=0;
    PORTC=angka[menitsat];
    delay_ms(1);

    PORTD.5=0;
    PORTD.6=1;
    PORTD.7=1;
    PORTC=angka[menitpul];
    delay_ms(1);
}
void tampil5()
{
    PORTD.5=1;
    PORTD.6=1;
    PORTD.7=0;
    PORTC=angka[jamsat];
    delay_ms(1);

    PORTD.5=1;
    PORTD.6=0;
    PORTD.7=1;
    PORTC=angka[jampul];
    delay_ms(1);

    PORTD.5=1;
    PORTD.6=1;
    PORTD.7=1;
    PORTC=angka[jampul];
    delay_ms(1);
    }

void main(void)
{
// Declare your local variables here
PORTA.1=0;
PORTA.2=0;
PORTD.1=0;
PORTD.2=1;
PORTD.3=1;
PORTD.4=1;
PORTD.5=1;
PORTD.6=1;
PORTD.7=1;
suhu2=36;
// Input/Output Ports initialization
// Port A initialization
```

```
// Func7=In Func6=In Func5=Out Func4=Out Func3=Out Func2=Out
Func1=Out Func0=Out
// State7=T State6=T State5=0 State4=0 State3=0 State2=0 State1=0 State0=0
PORTA=0x30;
DDRA=0x0F;

// Port B initialization
// Func7=In Func6=Out Func5=Out Func4=Out Func3=In Func2=In Func1=In
Func0=In
// State7=P State6=1 State5=1 State4=1 State3=P State2=P State1=P State0=P
PORTB=0xFF;
DDRB=0x70;

// Port C initialization
// Func7=Out Func6=Out Func5=Out Func4=Out Func3=Out Func2=Out
Func1=Out Func0=Out
// State7=0 State6=0 State5=0 State4=0 State3=0 State2=0 State1=0 State0=0
PORTC=0xFF;
DDRC=0xFF;

// Port D initialization
// Func7=Out Func6=Out Func5=Out Func4=Out Func3=Out Func2=Out
Func1=Out Func0=Out
// State7=0 State6=0 State5=0 State4=0 State3=0 State2=0 State1=0 State0=0
DDRD=0xFF;

// Timer/Counter 0 initialization
// Clock source: System Clock
// Clock value: Timer 0 Stopped
// Mode: Normal top=0xFF
// OC0 output: Disconnected
TCCR0=0x00;
TCNT0=0x00;
OCR0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
// Clock value: 62,500 kHz
// Mode: Normal top=0xFFFF
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer1 Overflow Interrupt: On
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
```

```
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x04;
TCNT1H=0x0B;
TCNT1L=0xDC;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;

// Timer/Counter 2 initialization
// Clock source: System Clock
// Clock value: Timer2 Stopped
// Mode: Normal top=0xFF
// OC2 output: Disconnected
ASSR=0x00;
TCCR2=0x00;
TCNT2=0x00;
OCR2=0x00;

// External Interrupt(s) initialization
// INT0: Off
// INT1: Off
// INT2: Off
MCUCR=0x00;
MCUCSR=0x00;

// Timer(s)/Counter(s) Interrupt(s) initialization
TIMSK=0x04;

// USART initialization
// USART disabled
UCSRB=0x00;

// Analog Comparator initialization
// Analog Comparator: Off
// Analog Comparator Input Capture by Timer/Counter 1: Off
ACSR=0x80;
SFIOR=0x00;

// ADC initialization
// ADC Clock frequency: 125,000 kHz
// ADC Voltage Reference: AREF pin
// ADC Auto Trigger Source: Free Running
```

```
ADMUX=ADC_VREF_TYPE & 0xff;
ADCSRA=0xA7;
SFIOR&=0x1F;

// SPI initialization
// SPI disabled
SPCR=0x00;

// TWI initialization
// TWI disabled
TWCR=0x00;

// Global enable interrupts
#asm("sei")

while (1)
 {
  if (PINA.4==0)
  {
   if (a==1)
   {
    data=read_adc(7);
    suhu=data*100/1023;
    data2=read_adc(6);
    suhu5=data2*100/1023;
    PORTA.1=1;

    if (suhu>=suhu2)
    {
     PORTA.1=0;
    }

    if (suhu<suhu2)
    {
     PORTA.1=1;
    }
   }

   if (a==2)
   {
    suhu=0;
    suhu5=0;
    PORTA.1=0;
   }
  }
```

```
if (PINA.4==1)
{
 suhu=0;
 suhu5=0;
 PORTA.1=0;
 a=0;
 suhu2=36;
}

if (PINA.5==0)
{
 data2=read_adc(7);
 suhu5=data2*100/1023;
}

for(x=0;x<100;x++)
{
 if (PINA.5==0)
 {
  if (PINB.4==0) {b=1;}
  if (PINB.5==0) {b=2;}
  if (PINB.6==0) {b=4;}
  if (PINB.7==0)
  {
   b=0;
   PORTD.1=0;
   detik=0;
   menit=0;
   PORTA.2=0;
   PORTA.3=0x00;
   PORTB.4=0xFF;
   PORTB.5=0xFF;
   PORTB.6=0xFF;
  }

   if (b==1)
   {
    PORTA.2=1;
    PORTB.4=0x00;
    PORTB.5=0XFF;
    PORTB.6=0XFF;

    if (jam==1)
    {
     jam=1;
     detik=0;
```

```
     PORTA.3=0x00;
     PORTA.2=0;
     PORTD.1=1;
    }
   }

  if (b==2)
  {
   PORTB.5=0x00;
   PORTB.6=0XFF;
   PORTB.4=0XFF;
   PORTA.2=1;

   if (menit==2)
   {
    menit=2;
    detik=0;
    PORTA.3=0x00;
    PORTA.2=0;
    PORTD.1=1;
   }
  }

  if (b==4)
  {
   PORTB.6=0x00;
   PORTB.4=0XFF;
   PORTB.5=0XFF;
   PORTA.2=1;

   if (menit==3)
   {
    menit=3;
    detik=0;
    PORTA.3=0x00;
    PORTA.2=0;
    PORTD.1=1;
   }
  }
ambil_data3();
tampilkan_seven_segment3();
ambil_data4();
tampil4();
ambil_data5();
tampil5();
ambil_data6();
```

```
}

if (PINA.5==1)
{
  b=0;
  PORTD.1=0;
  detik=0;
  menit=0;
  PORTA.2=0;
  PORTA.3=0x00;
  PORTB.4=0xFF;
  PORTB.5=0xFF;
  PORTB.6=0xFF;
}

if (PINA.4==0)
{
 if (PINB.1==0) {a=1;}
 if (PINB.0==0) {a=2;}

 ambil_data();
 tampilkan_seven_segment();
 ambil_data2();
 tampilkan_seven_segment2();
 ambil_data3();
 tampilkan_seven_segment3();

 if (PINB.3==0)
 {
  suhu2=suhu2+0.01;
  if (suhu2>38.1)
  {
   suhu2=36;
  }
 }

 if (PINB.2==0)
 {
  suhu2=suhu2-0.01;
  if (suhu2<36)
  {
   suhu2=38.1; }}}}}}
```