Lampiran

1.1 Perhitungan pengukuran timer 5 menit (300 detik)

    a Rata-rata

       Rata-rata $\overline{X} = \dfrac{\sum Xn}{n}$

       Diketahui :

       $\overline{X}$ = rata-rata…..?

       $\sum Xn$ = 5999 detik (Hasil penjumlahan 20 data)

       n   = 20

       Dimana :

       $\overline{X} = \dfrac{5999}{20} = 299{,}95$ detik

    b *% Error*

       % Error $= \dfrac{Xn - \overline{x}}{Xn} \text{X } 100$

       Diketahui:

       % Error = ….?

       Xn = 300 detik

       $\overline{X}$ = 299.95 detik

       Dimana:

       % Error $= \dfrac{300 - 299{,}95}{300} \text{ x } 100 = 0{,}0167\%$

1.2 Perhitungan pengukuran timer 10 menit (600 detik)

    a Rata-rata

       Rata-rata $\overline{X} = \dfrac{\sum Xn}{n}$

       Diketahui :

       $\overline{X}$ = rata-rata…..?

       $\sum Xn$ = 11974 detik (Hasil penjumlahan 20 data)

       n   = 20

       Dimana :

       $\overline{X} = \dfrac{11974}{20} = 598{,}7$ detik

c % *Error*

$$\% \, Error = \frac{Xn - \bar{x}}{Xn} \text{X } 100$$

Diketahui:

% *Error* = ….?

Xn = 600 detik

$\bar{X}$ = 598,7 detik

Dimana:

$$\% \, Error \quad = \frac{600 - 598,7}{600} \text{ x } 100 = 0,216\%$$

1.3 Perhitungan pengukuran timer 15 menit (900 detik)

a. Rata-rata

Rata-rata $\bar{X} = \frac{\sum Xn}{n}$

Diketahui :

$\bar{X}$ = rata-rata…..?

$\sum Xn$ = 17976 detik (Hasil penjumlahan 20 data)

n = 20

Dimana :

$$\bar{X} = \frac{17976}{20} = 898,8 \text{ detik}$$

b. % *Error*

$$\% \, Error = \frac{Xn - \bar{x}}{Xn} \text{X } 100$$

Diketahui:

% *Error* = ….?

Xn = 900 detik

$\bar{X}$ = 898,8 detik

Dimana:

$$\% \, Error \quad = \frac{900 - 898,8}{900} \text{ x } 100 = 0,133 \, \%$$

1.4 Perhitungan pengukuran suhu 37⁰ C

a. Rata-rata

Rata-rata $\bar{X} = \frac{\sum Xn}{n}$

Diketahui :

$\bar{X}$ = rata-rata…..?

$\sum Xn$ = 748,8⁰ C (Hasil penjumlahan 20 data)

n = 20

Dimana :

$\overline{X} = \dfrac{748,8}{20} = 37,44^0$ C

b. % *Error*

   % *Error* $= \dfrac{Xn - \overline{x}}{Xn}$X 100

   Diketahui:

   % *Error* = ….?

   Xn = 37,1⁰ C

   $\overline{X}$ = 37,44⁰ C

   Dimana:

   % *Error* $= \dfrac{37,1 - 37,44}{37,1}$ x 100 = 0,38%

1.5 Perhitungan pengukuran suhu 45⁰ C

   a. Rata-rata

   Rata-rata $\overline{X} = \dfrac{\sum Xn}{n}$

   Diketahui :

   $\overline{X}$ = rata-rata…..?

   $\sum Xn$ = 911,8⁰ C (Hasil penjumlahan 20 data)

   n = 20

   Dimana :

   $\overline{X} = \dfrac{911,8}{20} = 45,59^0$ C

   b. % *Error*

   % *Error* $= \dfrac{Xn - \overline{x}}{Xn}$X 100

   Diketahui:

   % *Error* = ….?

   Xn = 45,2⁰ C

   $\overline{X}$ = 45,59⁰ C

   Dimana:

   % *Error* $= \dfrac{45,2 - 45,59}{45,2}$ x 100 = 0,22%

1.6 Perhitungan pengukuran suhu 55^0 C

   a. Rata-rata

      Rata-rata $\overline{X} = \dfrac{\sum Xn}{n}$

      Diketahui :

      $\overline{X}$ = rata-rata…..?

      $\sum Xn$ = $1108,2^0$ C (Hasil penjumlahan 20 data)

      n   = 20

      Dimana :

      $\overline{X} = \dfrac{1108,2}{20} = 55,41^0$ C

   b. *% Error*

      % Error $= \dfrac{Xn - \overline{x}}{Xn}$X 100

      Diketahui:

      % Error = ….?

      Xn = $55,2^0$ C

      $\overline{X}$ = $55,41^0$ C

      Dimana:

      % Error $= \dfrac{55,2 - 55,41}{55,2}$ x 100 = 0,380%

1.7 Foto pembuatan alat
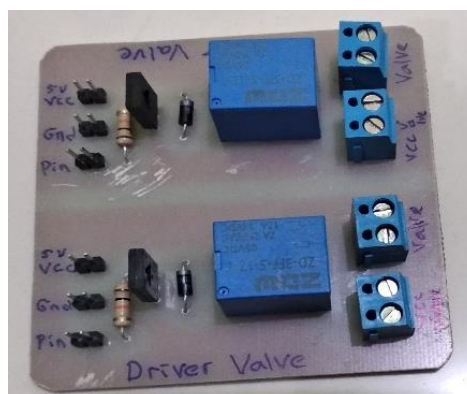
Driver valve
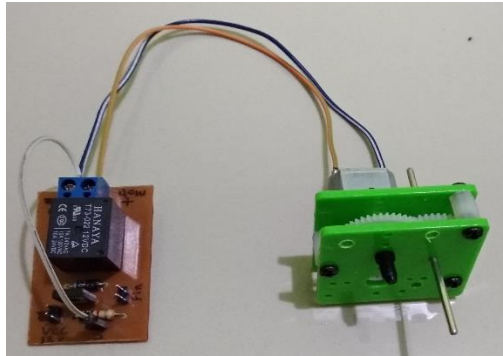
Driver motor dan *gerbox*

Perakitan body alat

Penempatan rangkaian utama pada body alat

Proses ujicoba alat dan pengambilan data

1.8 Coding program

```
Chip type                 : ATmega16
Program type              : Application
AVR Core Clock frequency: 12.000000 MHz
Memory model              : Small
External RAM size         : 0
Data Stack size           : 256
***************************************************/
#include <mega16.h>
#include <delay.h>
#include <alcd.h>
#include <stdio.h>
#include <stdlib.h>

int i,buffer,data2,data3=0,data4;
int count,detik=0, menit=0, jam=0;
float data1,suhu;
char temp[8];
unsigned char buf[8];
unsigned char buf2[8];
unsigned char time1[16];
unsigned char time2[16];
#define start PINB.6
#define upkec  PINB.0
#define downkec  PINB.1
#define upsuhu  PINB.2
#define downsuhu  PINB.3
#define uptimer  PINB.4
```

```c
#define hiter PORTD.7
#define buzzer PORTD.6
#define valve PORTD.1
#define valve2 PORTD.3
// -----------------------------------------------------------------
TCNT0=0x8B;
count++;
if(count>=100)
{
detik++;
count=0;
}
}

#define ADC_VREF_TYPE 0x40

void adc()
{
    buffer=0;
    for(i=0;i<=100;i++)
    {
     data1=read_adc(0);
     buffer=buffer+data1;
    }
    suhu=(float)(buffer/100)*500/1023+1;
    ftoa(suhu,2,temp);
    lcd_gotoxy(7,0);
    lcd_puts(temp);
    lcd_gotoxy(0,0);
    lcd_putsf("Temp : ");
    lcd_gotoxy(11,0);
    lcd_putchar(0xdf);
    lcd_putsf("C");
    delay_ms(500);
}

void hitung_waktu()
{
if (detik==60)
    {
    menit++;
    detik=0;
    lcd_clear();
    }
```

```c
   if (menit==60)
      {
      jam++;
      menit=0;
      lcd_clear();
      }
}

void tampil_lcd()
{
   lcd_gotoxy(0,1);
   lcd_putsf("Time :");
   lcd_gotoxy(7,1);
   itoa(menit,time1);
   lcd_puts(time1);
   lcd_gotoxy(9,1);
   lcd_putsf(":");
   lcd_gotoxy(10,1);
   itoa(detik,time2);
   lcd_puts(time2);
}

void menu2()
{
 if(!upsuhu)  {data2=data2+1;delay_ms(200);}
 if(!downsuhu){data2=data2-1;delay_ms(200);}
 //tombol setting menu2
 lcd_gotoxy(0,1);
 lcd_putsf("Set Temp  :");
 lcd_gotoxy(12,1);
 itoa(data2,buf);
 lcd_puts(buf);
 lcd_gotoxy(15,1);
 lcd_putchar(0xdf);
 lcd_putsf("C");
 if(data2<30){data2=80;}
 if(data2==80){ data2=30;}
 //mengatur volume maksimal yaitu data1
}

void menu3()
{
 if(!uptimer)  {data4=data4+5;delay_ms(200);}
 if(!downtimer){data4=data4-5;delay_ms(200);}
```

```c
//tombol setting menu2
lcd_gotoxy(0,2);
lcd_putsf("Timer    :");
lcd_gotoxy(12,2);
sprintf(buf2,"%d min",data4);
lcd_puts(buf2);
if(data4<5){data4=60;}
if(data4==65){ data4=5;}
//mengatur volume maksimal yaitu data1
}

void levelsatu()
{
hiter=0;
buzzer=0;
valve=0;
valve2=0;
lcd_gotoxy(12,0);
lcd_putsf("Level 1");
menu2();
menu3();
if(!start)
{
  lcd_clear();delay_ms(200);
  while(1)
  {
    adc();
    hitung_waktu();
    tampil_lcd();
    lcd_gotoxy(0,3);
    lcd_putsf("<PROSES BERLANGSUNG>");
    if(suhu>=data2){hiter=0;}
    else {hiter=1;}
    if(suhu>=data2)
    {
      TIMSK=0x01;
      OCR1B=100;
    }
    if(menit>=data4)
    {
      OCR1B=0;
      hiter=0;
      buzzer=1;
      lcd_clear();
```

```c
  lcd_gotoxy(2,2);
  lcd_putsf("<PROSES SELESAI>");
  adc();
}
if(menit>=data4+1)
{
while(1)
{
  buzzer=0;
  adc();
  hitung_waktu();
  lcd_gotoxy(2,2);
  lcd_putsf("<PROSES SELESAI>");
if(menit>=data4+2)
{
  lcd_clear();delay_ms(200);
  while(1)
  {
  hitung_waktu();
  lcd_gotoxy(0,2);
  lcd_putsf("<PROSES PENGOSONGAN>");
  adc();
  valve=1;
  hiter=0;
  buzzer=0;
  if(menit>=data4+4)
  {
  lcd_clear(); delay_ms(200);
  while(1)
  {
    lcd_gotoxy(1,2);
    lcd_putsf("<PROSES PENGISIAN>");
    hitung_waktu();
    adc();
    valve=0;
    valve2=1;
    hiter=0;
    buzzer=0;
    if(menit==data4+7)
    {
    lcd_clear(); delay_ms(200);
    while(1)
    {
    TIMSK=0x00;
```

```
                buzzer=1;
                valve=0;
                valve2=0;
                hiter=0;
                OCR1B=0;
                lcd_clear();
                lcd_gotoxy(2,2);
                lcd_putsf("<PROSES SELESAI>");
                adc();
                lcd_gotoxy(9,3);
                lcd_putsf("~Klik Reset"); delay_ms(500);
                }
                }
            }
            }
            }
            }
            }
        }
        }
    }
}

void leveldua()
{
 hiter=0;
 buzzer=0;
 valve=0;
 valve2=0;
 lcd_gotoxy(12,0);
 lcd_putsf("Level 2");
 menu2();
 menu3();
 if(!start)
 {
   lcd_clear();delay_ms(200);
   while(1)
   {
     adc();
     hitung_waktu();
     tampil_lcd();
     lcd_gotoxy(0,3);
     lcd_putsf("<PROSES BERLANGSUNG>");
     if(suhu>=data2){hiter=0;}
```

```c
else {hiter=1;}
if(suhu>=data2)
{
  TIMSK=0x01;
  OCR1B=200;
}
if(menit>=data4)
{
  OCR1B=0;
  hiter=0;
  buzzer=1;
  lcd_clear();
  lcd_gotoxy(2,2);
  lcd_putsf("<PROSES SELESAI>");
  adc();
}
if(menit>=data4+1)
{
while(1)
{
  buzzer=0;
  adc();
  hitung_waktu();
  lcd_gotoxy(2,2);
  lcd_putsf("<PROSES SELESAI>");
if(menit>=data4+2)
{
  lcd_clear();delay_ms(200);
  while(1)
  {
  hitung_waktu();
  lcd_gotoxy(0,2);
  lcd_putsf("<PROSES PENGOSONGAN>");
  adc();
  valve=1;
  hiter=0;
  buzzer=0;
  if(menit>=data4+4)
  {
  lcd_clear(); delay_ms(200);
  while(1)
  {
    lcd_gotoxy(1,2);
    lcd_putsf("<PROSES PENGISIAN>");
```

```c
        hitung_waktu();
        adc();
        valve=0;
        valve2=1;
        hiter=0;
        buzzer=0;
        if(menit==data4+7)
        {
        lcd_clear(); delay_ms(200);
        while(1)
        {
        TIMSK=0x00;
        buzzer=1;
        valve=0;
        valve2=0;
        hiter=0;
        OCR1B=0;
        lcd_clear();
        lcd_gotoxy(2,2);
        lcd_putsf("<PROSES SELESAI>");
        adc();
        lcd_gotoxy(9,3);
        lcd_putsf("~Klik Reset"); delay_ms(500);
        }
        }
    }
        }
        }
        }
    }
    }
  }
}

void leveltiga()
{
 hiter=0;
 buzzer=0;
 valve=0;
 valve2=0;
 lcd_gotoxy(12,0);
 lcd_putsf("Level 3");
 menu2();
 menu3();
```

```
if(!start)
{
 lcd_clear();delay_ms(200);
 while(1)
 {
  adc();
  hitung_waktu();
  tampil_lcd();
  lcd_gotoxy(0,3);
  lcd_putsf("<PROSES BERLANGSUNG>");
  if(suhu>=data2){hiter=0;}
  else {hiter=1;}
  if(suhu>=data2)
  {
    TIMSK=0x01;
    OCR1B=300;
  }
  if(menit>=data4)
  {
    OCR1B=0;
    hiter=0;
    buzzer=1;
    lcd_clear();
    lcd_gotoxy(2,2);
    lcd_putsf("<PROSES SELESAI>");
    adc();
  }
  if(menit>=data4+1)
  {
  while(1)
  {
    buzzer=0;
    adc();
    hitung_waktu();
    lcd_gotoxy(2,2);
    lcd_putsf("<PROSES SELESAI>");
  if(menit>=data4+2)
  {
    lcd_clear();delay_ms(200);
    while(1)
    {
    hitung_waktu();
    lcd_gotoxy(0,2);
    lcd_putsf("<PROSES PENGOSONGAN>");
```

```c
    adc();
    valve=1;
    hiter=0;
    buzzer=0;
    if(menit>=data4+4)
    {
    lcd_clear(); delay_ms(200);
    while(1)
    {
       lcd_gotoxy(1,2);
       lcd_putsf("<PROSES PENGISIAN>");
       hitung_waktu();
       adc();
       valve=0;
       valve2=1;
       hiter=0;
       buzzer=0;
       if(menit==data4+7)
       {
       lcd_clear(); delay_ms(200);
       while(1)
       {
       TIMSK=0x00;
       buzzer=1;
       valve=0;
       valve2=0;
       hiter=0;
       OCR1B=0;
       lcd_clear();
       lcd_gotoxy(2,2);
       lcd_putsf("<PROSES SELESAI>");
       adc();
       lcd_gotoxy(9,3);
       lcd_putsf("~Klik Reset"); delay_ms(500);
       }
       }
     }
     }
     }
     }
    }
   }
  }
}
```

```
void menu()
{
hiter=1;
if(!upkec) {data3=data3+1; delay_ms(500);lcd_clear();}
if(!downkec){data3=data3-1; delay_ms(500);lcd_clear();}
if(data3==3){data3=0;}
if(data3<0){data3=3;}
switch(data3)
 {
  case 0 :levelsatu();break;
  case 1 :leveldua();break;
  case 2 :leveltiga();break;
 }     //setting menu tampilan awal
}

// Declare your global variables here
// -------------------------------------------------------------------------
lcd_init(20);
#asm("sei")
 lcd_gotoxy(6,0);
 lcd_putsf("SHAKHING");
 lcd_gotoxy(5,1);
 lcd_putsf("WATER BATH");
 delay_ms(1000);
 lcd_gotoxy(1,3);
 lcd_putsf("T.ELEKTROMEDIK-UMY");
 delay_ms(2000);
 lcd_clear();
 lcd_gotoxy(7,1);
 lcd_putsf("SUMARDI");
 lcd_gotoxy(5,2);
 lcd_putsf("20163010045");
 delay_ms(2000);
 lcd_clear();
while (1)
    {
     lcd_gotoxy(0,0);
     lcd_putsf("Kecepatan :");
     menu();
     menu2();
     menu3();
     lcd_gotoxy(4,3);
     lcd_putsf("TEKAN ENTER >>");
    }
```