

LAMPIRAN

ANALISIS PERHITUNGAN *TIMER*

1. Hasil Perhitungan Waktu 10 Detik

a. Rata-rata Data

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$\begin{aligned}(\bar{x}) &= (9.98+10.06+09.99+09.73+09.92+09.99+10.11+09.79+09.98+09.93+ \\ &\quad 09.99+09.99+09.99+10.00+10.06+09.94+09.91+09.92+09.98+09.99)/20 \\ &= 9,9625\end{aligned}$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 10-9,9625$$

$$\text{Simpangan} = 0,0375$$

c. Presentase *Error*

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{10 - (9,9625)}{10} \times 100\%$$

$$\% \text{ Error} = 0\%$$

d. *Standart Deviasi*

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$\begin{aligned}
SD &= \sqrt{(9,98-9,9625)^2+(10,06-9,9625)^2+(9,99-9,9625)^2+(9,73-9,9625)^2+(9,92- \\
&9,9625)^2+(9,99-9,9625)^2+(10,11-9,9625)^2+(9,79-9,9625)^2+(9,98- \\
&9,9625)^2+(9,93-9,9625)^2+(9,99-9,9625)^2+(9,99-9,9625)^2+(9,99- \\
&9,9625)^2+(10,00-9,9625)^2+(10,06-9,9625)^2+(9,94-9,9625)^2+(9,91- \\
&9,9625)^2+(9,92-9,9625)^2+(9,98-9,9625)^2+(9,99-9,9625)^2}/19 \\
SD &= 0,855
\end{aligned}$$

e. Presisi

$$\begin{aligned}
&= 100 \% \left(1 - \frac{3xS \tan \text{dartDeviasi}}{\bar{X}} \right) \\
&= 100 \% \left(1 - \frac{3x0,0855}{9,9625} \right) \\
&= 97 \%
\end{aligned}$$

2. Hasil Perhitungan Waktu 20 Detik

a. Rata-rata Data

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$\begin{aligned}
(\bar{x}) &= (19.79+19.82+19.79+19.77+19.90+19.77+19.90+19.82+19.75+19.76+ \\
&19.68+19.78+19.72+19.70+20.09+19.84+19.76+19.77+19.85+19.84)/20 \\
&= 19,805
\end{aligned}$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 20-19,805$$

$$\text{Simpangan} = 0,195$$

c. *Presentase Error*

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{20 - (39,4305)}{20} \times 100\%$$

$$\% \text{ Error} = 1\%$$

d. *Standart Deviasi*

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$SD = \sqrt{(19,79-19,805)^2 + (19,82-19,805)^2 + (19,79-19,805)^2 + (19,77-19,805)^2 + (19,90-19,805)^2 + (19,77-19,805)^2 + (19,90-19,805)^2 + (19,82-19,805)^2 + (19,75-19,805)^2 + (19,76-19,805)^2 + (19,68-19,805)^2 + (19,78-19,805)^2 + (19,72-19,805)^2 + (19,70-19,805)^2 + (20,09-19,805)^2 + (19,84-19,805)^2 + (19,76-19,805)^2 + (19,77-19,805)^2 + (19,85-19,805)^2 + (19,84-19,805)^2 / 19}$$

$$SD = 0,088$$

e. *Presi*

$$= 100 \% \left(1 - \frac{3xS \text{ tan } \textit{dartDeviasi}}{\bar{X}} \right)$$

$$= 100 \% \left(1 - \frac{3x0,088}{19,805} \right)$$

$$= 99 \%$$

3. Hasil Perhitungan Waktu 30 Detik

a. *Rata-rata Data*

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$(\bar{X}) = \frac{(29.49+29.57+29.57+29.56+29.57+29.50+29.55+29.55+29.54+29.42+29.56+29.68+29.74+29.51+29.50+29.49+29.78+29.42+29.56+29.69)}{20}$$

$$= 29,5625$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 30 - 29,5625$$

$$\text{Simpangan} = 0,437$$

c. Presentase Error

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{30 - (29,5625)}{30} \times 100\%$$

$$\% \text{ Error} = 1\%$$

d. Standart Deviasi

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$SD = \sqrt{(29,49-29,5625)^2 + (29,57-29,5625)^2 + (29,57-29,5625)^2 + (29,56-29,5625)^2 + (29,57-29,5625)^2 + (29,50-29,5625)^2 + (29,55-29,5625)^2 + (29,55-29,5625)^2 + (29,54-29,5625)^2 + (29,42-29,5625)^2 + (29,56-29,5625)^2 + (29,68-29,5625)^2 + (29,74-29,5625)^2 + (29,51-29,5625)^2 + (29,50-29,5625)^2 + (29,49-29,5625)^2 + (29,78-29,5625)^2 + (29,42-29,5625)^2 + (29,56-29,5625)^2 + (29,69-29,5625)^2}$$

$$\begin{aligned} & 29,5625)^2 + (29,78 - 29,5625)^2 + (29,42 - 29,5625)^2 + (29,56 - \\ & 29,5625)^2 + (29,69 - 29,5625)^2 / 19 \end{aligned}$$

$$SD = 0,095$$

e. Presisi

$$= 100 \% \left(1 - \frac{3 \times S \tan \text{ dart Deviasi}}{\bar{X}} \right)$$

$$= 100 \% \left(1 - \frac{3 \times 0,095}{29,5625} \right)$$

$$= 99 \%$$

4. Hasil Perhitungan Waktu 40 Detik

a. Rata-rata Data

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$(\bar{X}) = (39,50 + 39,34 + 39,26 + 39,36 + 39,35 + 39,41 + 39,34 + 39,46 + 39,29 + 39,34 +$$

$$39,42 + 39,21 + 39,41 + 39,46 + 39,59 + 39,43 + 39,50 + 39,50 + 39,67 + 39,77) / 20$$

$$= 39,4305$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 30 - 39,4305$$

$$\text{Simpangan} = 0,5695$$

c. Presentase Error

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{30 - (39,4305)}{30} \times 100\%$$

$$\% \text{ Error} = 1\%$$

d. *Standart Deviasi*

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$SD = \sqrt{(39,50-39,4305)^2 + (39,34-39,4305)^2 + (39,26-39,4305)^2 + (39,36-39,4305)^2 + (39,35-39,4305)^2 + (39,41-39,4305)^2 + (39,34-39,4305)^2 + (39,46-39,4305)^2 + (39,29-39,4305)^2 + (39,34-39,4305)^2 + (39,42-39,4305)^2 + (39,21-39,4305)^2 + (39,41-39,4305)^2 + (39,46-39,4305)^2 + (39,59-39,4305)^2 + (39,43-39,4305)^2 + (39,50-39,4305)^2 + (39,50-39,4305)^2 + (39,67-39,4305)^2 + (39,77-39,4305)^2 / 19}$$

$$SD = 0,135$$

e. *Presisi*

$$= 100\% \left(1 - \frac{3 \times S \tan \text{dartDeviasi}}{\bar{X}} \right)$$

$$= 100\% \left(1 - \frac{3 \times 0,135}{39,4305} \right)$$

$$= 99\%$$

5. Hasil Perhitungan Waktu 50 Detik

a. *Rata-rata Data*

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$\begin{aligned}
 (\bar{X}) &= (49.21+49.08+49.07+49.12+49.13+49.07+49.11+49.12+49.33+49.01+ \\
 &\quad 49.08+49.12+49.13+49.22+49.21+49.25+49.29+49.27+49.30+49.31)/20 \\
 &= 49,1715
 \end{aligned}$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 50-49,1715$$

$$\text{Simpangan} = 0,8285$$

c. Presentase *Error*

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{50 - (49,1715)}{50} \times 100\%$$

$$\% \text{ Error} = 2\%$$

d. *Standart Deviasi*

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$\begin{aligned}
 SD &= \sqrt{(49,21-49,1715)^2+(49,08-49,1715)^2+(49,07-49,1715)^2+(49,12- \\
 &\quad 49,1715)^2+(49,13-49,1715)^2+(49,07-49,1715)^2+(49,11- \\
 &\quad 49,1715)^2+(49,12-49,1715)^2+(49,33-49,1715)^2+(49,01- \\
 &\quad 49,1715)^2+(49,08-49,1715)^2+(49,12-49,1715)^2+(49,13- \\
 &\quad 49,1715)^2+(49,22-49,1715)^2+(49,21-49,1715)^2+(49,25- \\
 &\quad 49,1715)^2+(49,29-49,1715)^2+(49,27-49,1715)^2+(49,30- \\
 &\quad 49,1715)^2+(49,31-49,1715)^2}
 \end{aligned}$$

$$SD = 0,095$$

e. Presisi

$$= 100 \% \left(1 - \frac{3 \times S \tan \text{dartDeviasi}}{\bar{X}} \right)$$

$$= 100 \% \left(1 - \frac{3 \times 0,095}{49,1715} \right)$$

$$= 99 \%$$

6. Hasil Perhitungan Waktu 60 Detik

a. Rata-rata Data

$$(\bar{X}) = \frac{\sum Xi}{n}$$

$$(\bar{X}) = \frac{(58.98+58.10+58.99+58.32+58.67+58.99+58.66+58.78+58.84+58.82+58.92+58.93+58.82+58.84+59.93+58.99+58.91+58.92+58.82+58.84)/20}{}$$

$$= 58,846$$

b. Simpangan

$$\text{Simpangan} = Y - \bar{X}$$

$$\text{Simpangan} = 60 - 58,7295$$

$$\text{Simpangan} = 1,153$$

c. Presentase Error

$$\% \text{ Error} = \frac{Xn - (\bar{X})}{Xn} \times 100\%$$

$$\% \text{ Error} = \frac{60 - (58,8468)}{60} \times 100\%$$

$$\% \text{ Error} = 2\%$$

d. *Standart Deviasi*

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

$$SD = \sqrt{(58,98-58,8468)^2 + (58,10-58,8468)^2 + (58,99-58,8468)^2 + (58,32-58,8468)^2 + (58,67-58,8468)^2 + (58,99-58,8468)^2 + (58,66-58,8468)^2 + (58,78-58,8468)^2 + (58,84-58,8468)^2 + (58,82-58,8468)^2 + (58,92-58,8468)^2 + (58,93-58,8468)^2 + (58,82-58,8468)^2 + (58,84-58,8468)^2 + (58,93-58,8468)^2 + (58,99-58,8468)^2 + (58,91-58,8468)^2 + (58,92-58,8468)^2 + (58,82-58,8468)^2 + (58,84-58,8468)^2}$$

$$SD = 0,944$$

e. *Presisi*

$$= 100 \% \left(1 - \frac{3 \times S \tan \text{ dartDeviasi}}{\bar{X}} \right)$$

$$= 100 \% \left(1 - \frac{3 \times 0,944}{58,846} \right)$$

$$= 95 \%$$

Memasukan library yang akan digunakan ke dalam program

```
#include <mega8.h>
#include <stdlib.h>
#include <stdio.h>
#include <delay.h>
```

Inialisasi sebutan nama lain panggilan PIN atau PORT dalam program

```
#define up      PINC.0
#define down    PINC.1
#define ok      PINC.2
#define cancel  PINC.3
```

void menu();// memanggil fungsi void agar bisa diakses secara global
menginisialisasi fungsi2 yang akan dipergunakan

```
unsigned int hitung=0, mikrodetik;
int detik;
unsigned char chitung[10], temp[2],temp2[2];
```

memasukkan library lcd ke dalam program yang dibuat

```
// Alphanumeric LCD Module functions
#include <alcd.h>
```

Program rutin timer untuk interrupt. Kepastiannya kapan interrupt berdasarkan pengaturan dari clock yang dipergunakan. Menggunakan timer 2 untuk interrupt.

```
// Timer2 overflow interrupt service routine
interrupt [TIM2_OVF] void timer2_ovf_isr(void)
{
// Reinitialize Timer2 value
TCNT2=0x8A;
// Place your code here
mikrodetik++;
if(mikrodetik==8)
{
detik--;
mikrodetik=0;}
}
```

// Declare your global variables here

Program yang berisi tampilan di lcd 16x2 mengenai informasi pembuat alat dan nama alat.

```
void menuawal()
{
    lcd_gotoxy(0,0);
    lcd_putsf("  WELCOME");
    lcd_gotoxy(0,1);
    lcd_putsf("  Tugas Akhir ");
    delay_ms(150);
    lcd_clear();
    lcd_gotoxy(0,0);
    lcd_putsf("  Light Curing");
    lcd_gotoxy(0,1);
    lcd_putsf("  Zainul Hamidah ");
    delay_ms(250);
    lcd_clear();
    for (hitung=0;hitung<=5;hitung++)
    {
        lcd_clear();
        itoa (hitung,chitung);
```

```

        lcd_clear();
        lcd_gotoxy(0,0);
        lcd_putsf("Mohon Tunggu");
        lcd_gotoxy(7,1);
        lcd_puts(chitung);
        delay_ms(50);
    }
    lcd_clear();
}

```

Menampilkan perhitungan waktu pada lcd dimana besarnya waktu telah diolah pada program interrupt timer 2 diatas.

```

void waktu()
{
    if(detik<10)
    {
        lcd_gotoxy(0,0);
        lcd_putsf("0");
        lcd_gotoxy(1,1);
        itoa(detik,temp2);
        lcd_puts(temp2);
        lcd_gotoxy(2,1);
        lcd_putsf(" detik");
    }
    else
    {
        lcd_gotoxy(0,1);
        itoa(detik,temp);
        lcd_puts(temp);
        lcd_gotoxy(2,1);
        lcd_putsf(" detik");
    }
}

```

Menu program yang berisikan pengaturan kecepatan berapa detik led akan menyala. Terdapat 6 pemilihan waktu.

```

// menu tampilan di lcd
void menu()
{
    lcd_clear();
menu01:
    delay_ms(10);
    lcd_gotoxy(0,0);
    lcd_putsf(" 10 detik  ");
    lcd_gotoxy(0,1);
    lcd_putsf(" 20 detik  ");
    //----- kursor awal-----
    lcd_gotoxy(0,0);
    lcd_putchar('>');
    if(ok==0)
    {
        lcd_clear();
        detik=10;
        goto keluar;
    }
    if(down==0)
    {
        lcd_clear();

```

```

        goto menu02;
    }
    goto menu01;

menu02:
    delay_ms(10); // bouncing sw
    lcd_gotoxy(0,0);
    lcd_putsf(" 10 detik ");
    lcd_gotoxy(0,1);
    lcd_putsf(" 20 detik ");
//----- kursor awal-----
    lcd_gotoxy(0,1);
    lcd_putchar('>');
    if (ok==0)
    {
        lcd_clear();
        detik=20;
        goto keluar;
    }
    if (up==0)
    {
        lcd_clear();
        goto menu01;
    }
    if (down==0)
    {
        lcd_clear();
        goto menu03;
    }
    goto menu02;

menu03:
    delay_ms(10); // bouncing sw
    lcd_gotoxy(0,0);
    lcd_putsf(" 30 detik"); //Lihat Sensor ";
    lcd_gotoxy(0,1);
    lcd_putsf(" 40 detik");
//----- kursor awal-----
    lcd_gotoxy(0,0);
    lcd_putchar('>');
    if (ok==0)
    {
        lcd_clear();
        detik=30;
        goto keluar;
    }
    if (up==0)
    {
        lcd_clear();
        goto menu02;
    }
    if (down==0)
    {
        lcd_clear();
        goto menu04;
    }
    goto menu03;

```

```

menu04:
    delay_ms(10);    // bouncing sw
    lcd_gotoxy(0,0);
    lcd_putsf(" 30 detik");
    lcd_gotoxy(0,1);
    lcd_putsf(" 40 detik");
//----- kursor awal-----
    lcd_gotoxy(0,1);
    lcd_putchar('>');
    if (ok==0)
    {
        lcd_clear();
        detik=40;
        goto keluar;
    }
    if (up==0)
    {
        lcd_clear();
        goto menu03;
    }
    goto menu04;
menu05:
    delay_ms(10);    // bouncing sw
    lcd_gotoxy(0,0);
    lcd_putsf(" 30 detik");    //Lihat Sensor ");
    lcd_gotoxy(0,1);
    lcd_putsf(" 40 detik");
//----- kursor awal-----
    lcd_gotoxy(0,0);
    lcd_putchar('>');
    if (ok==0)
    {
        lcd_clear();
        detik=50;
        goto keluar;
    }
    if (up==0)
    {
        lcd_clear();
        goto menu04;
    }
    if (down==0)
    {
        lcd_clear();
        goto menu06;
    }
    goto menu05;
menu06:
    delay_ms(10);    // bouncing sw
    lcd_gotoxy(0,0);
    lcd_putsf(" 50 detik");
    lcd_gotoxy(0,1);
    lcd_putsf(" 60 detik");
//----- kursor awal-----
    lcd_gotoxy(0,1);
    lcd_putchar('>');

```

```

        if (ok==0)
        {
            lcd_clear();
            detik=60;
            goto keluar;
        }
        if (up==0)
        {
            lcd_clear();
            goto menu05;
        }
        goto menu06;
keluar:
lcd_clear();
delay_ms(100);
}

```

Program utama yang berisikan register2 yang digunakan pada program ini

```

void main(void)
{
    PORTC=0x7F;
    DDRC=0x00;

    PORTD=0x00;
    DDRD=0x01;

    // Timer/Counter 2 initialization
    ASSR=0x00;
    TCCR2=0x00;
    TCNT2=0x8A;
    OCR2=0x00;

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

    // Alphanumeric LCD initialization
    // Connections specified in the
    // Project|Configure|C Compiler|Libraries|Alphanumeric LCD menu:
    // RS - PORTB Bit 0
    // RD - PORTB Bit 6
    // EN - PORTB Bit 1
    // D4 - PORTB Bit 2
    // D5 - PORTB Bit 3
    // D6 - PORTB Bit 4
    // D7 - PORTB Bit 5
    // Characters/line: 16
    lcd_init(16);

    // Global enable interrupts
    #asm("sei")
    menuawal(); // pertama kali program tampilan mengenai informasi
    alat akan muncul.

```

Program yang akan dilakukan secara terus- menerus atau rutin program

```
while (1)
```

```
{
// Place your code here
menu();
kerja01:
  TCCR2=0x07;
  PORTD.0=1;
  waktu();
  if (detik==0)
  {
    TCCR2=0x00;
    PORTD.0=0;
    goto kerja02;
  }
  goto kerja01;
kerja02:
  lcd_clear();
  delay_ms(500);
}
}
```