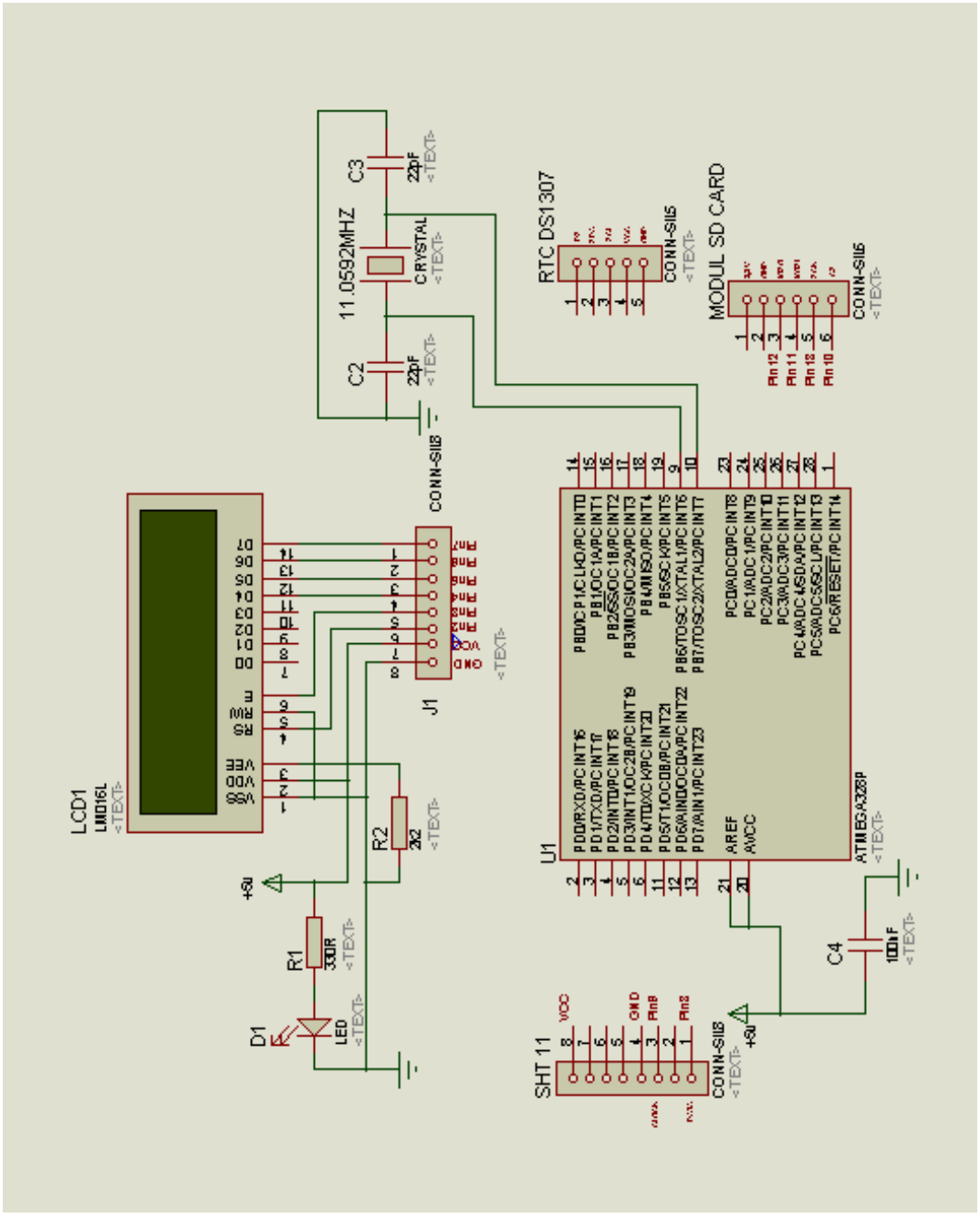
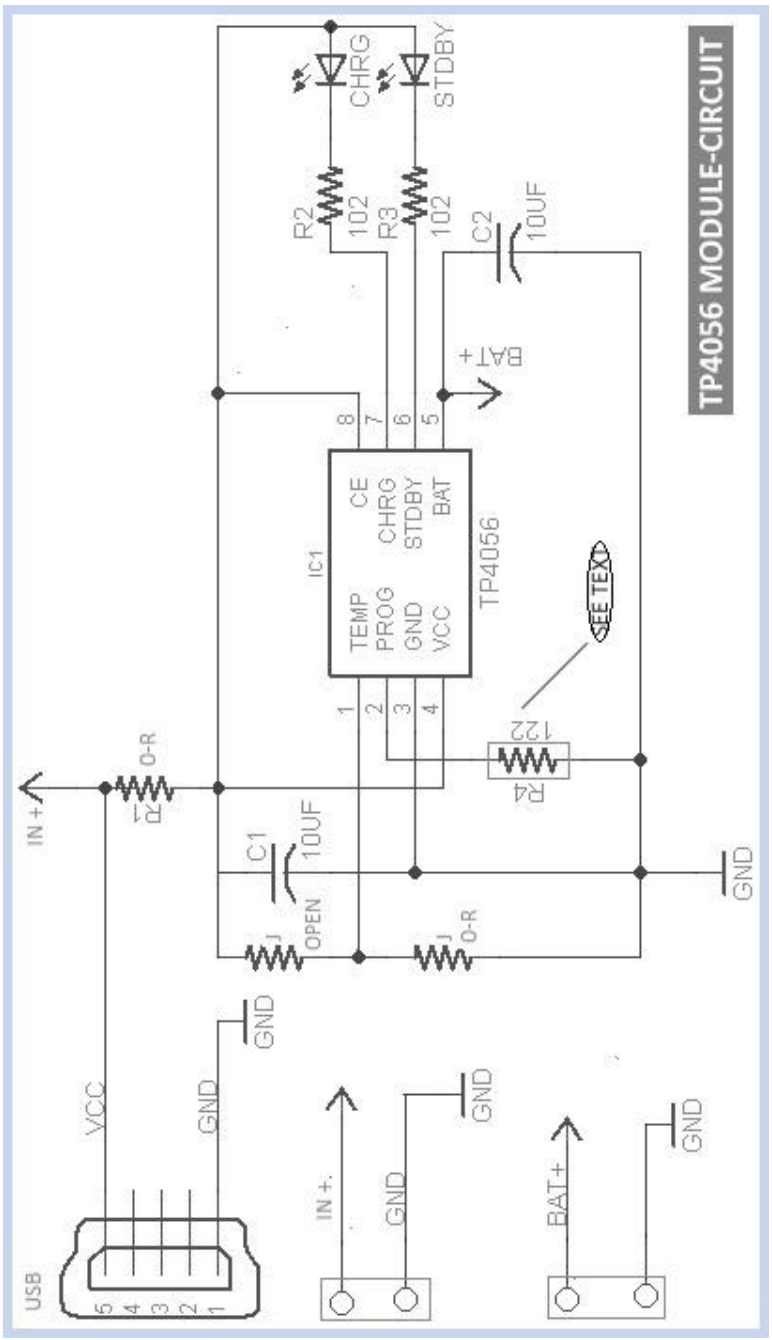
LAMPIRAN

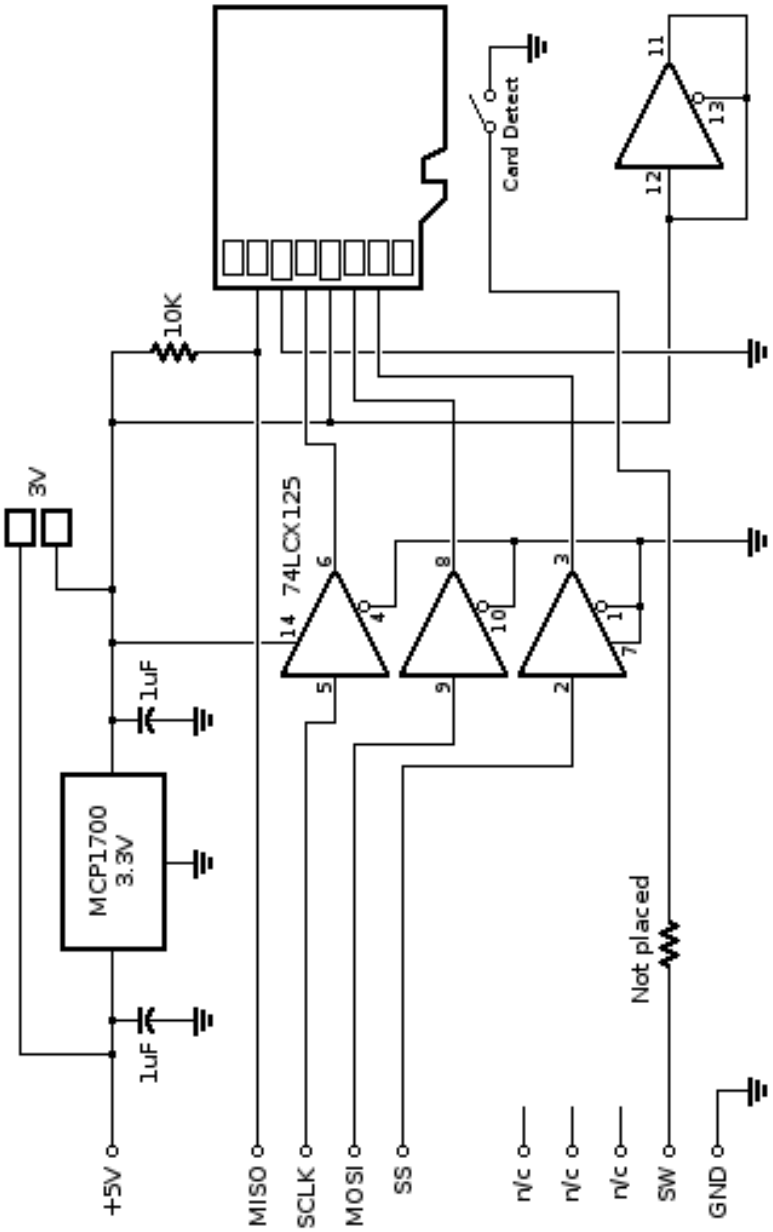
RANGKAIAN KESELURUHAN



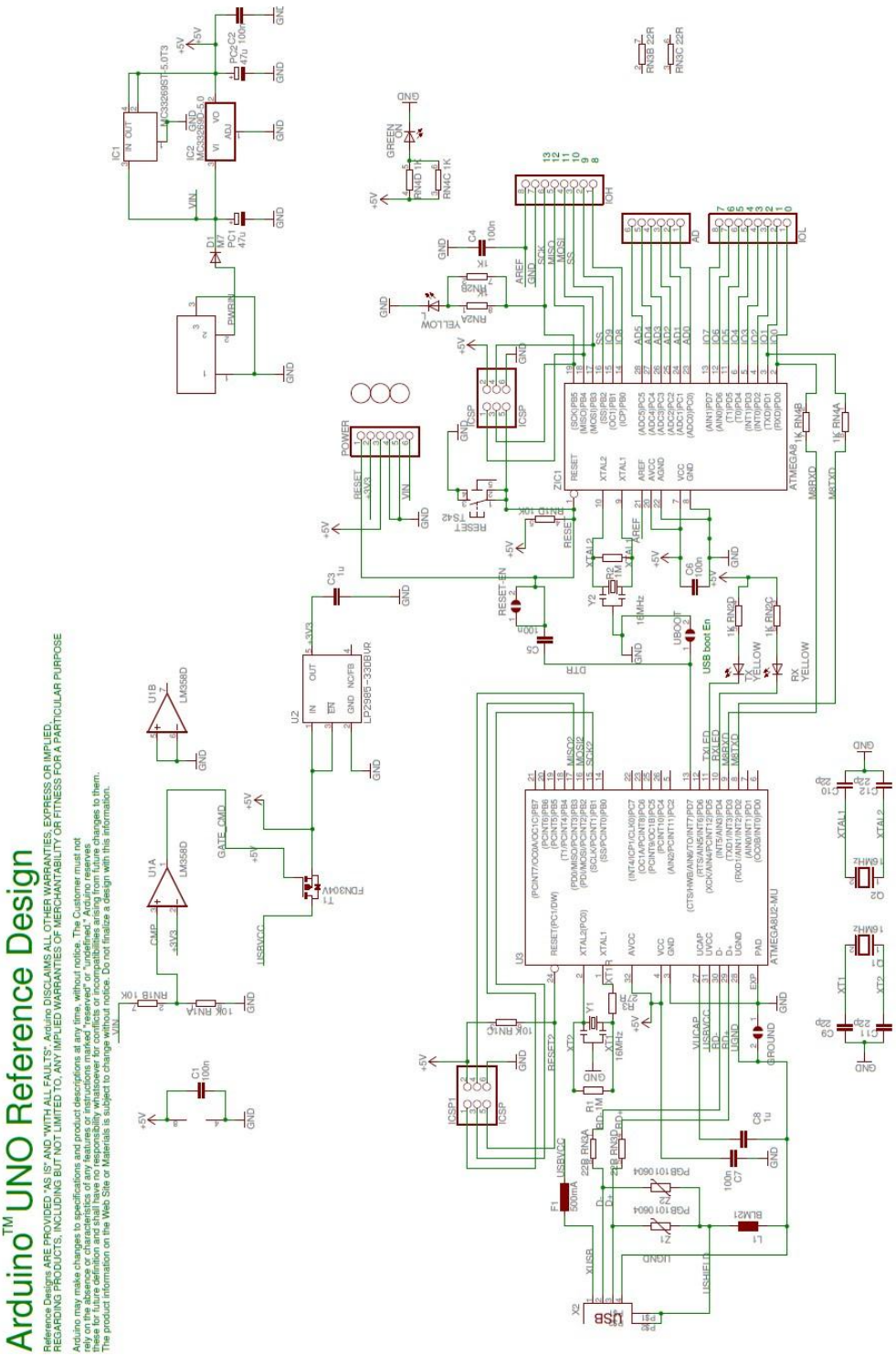
WIRING MODUL CHARGER



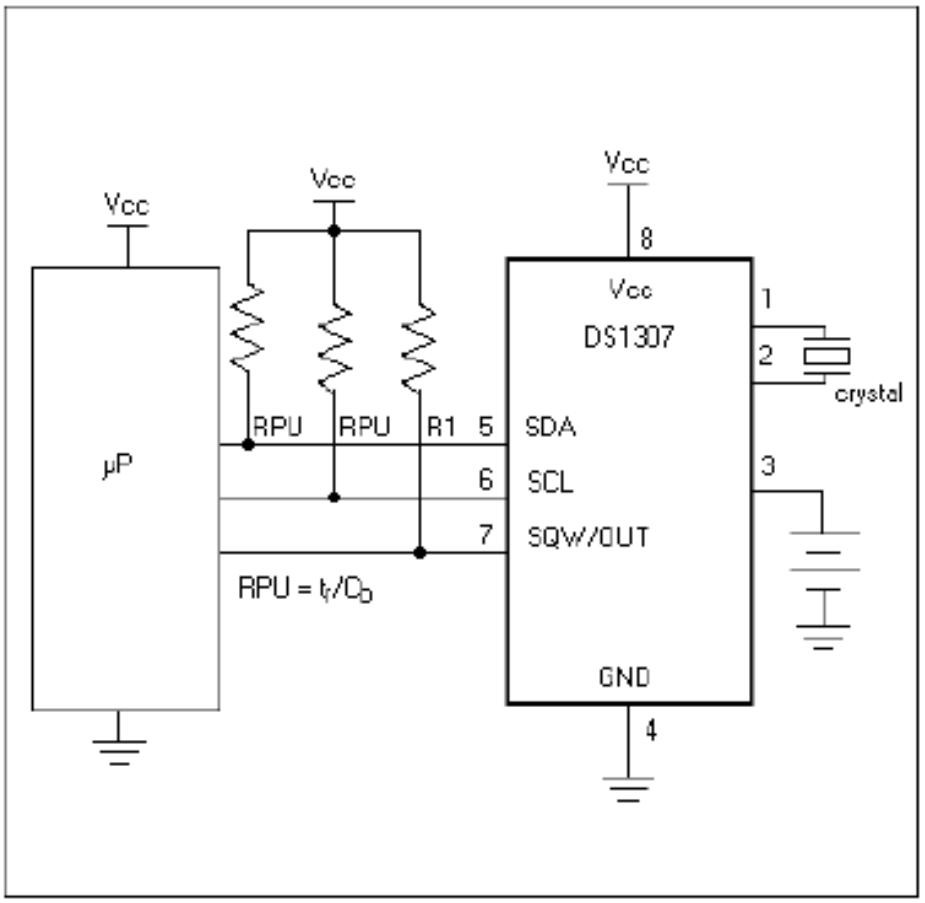
WIRING MODUL SD CARD



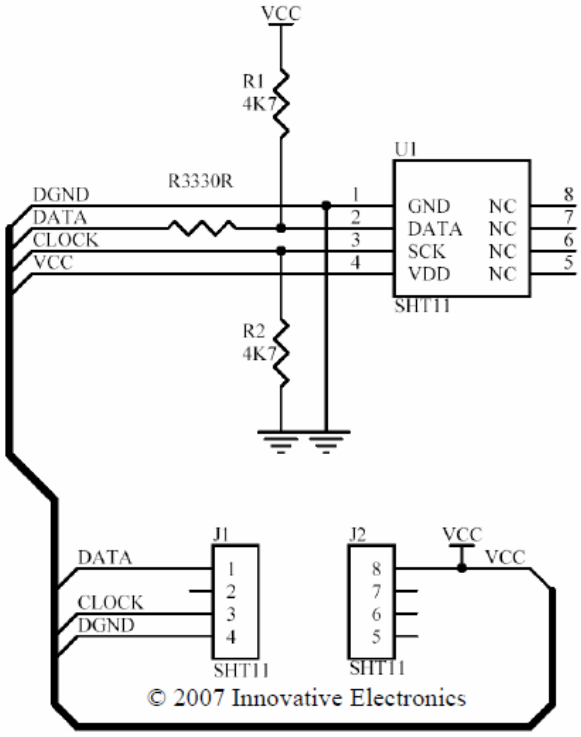
WIRING ARDUINO UNO



WIRING RTC


Vcc
Vcc
Vcc
8
Vcc
DS1307
1
2
crystal
3
µP
RPU
RPU
R1
5
SDA
6
SCL
7
SQW/OUT
RPU = tr/CB
GND
4

WIRING SHT11



LISTING PROGRAM

Listing 3.1 berikut :

```
#include <SHT1x.h>// sht library
#include <LiquidCrystal.h>// lcd library
LiquidCrystal lcd(2, 3, 4, 5, 6, 7); // konfigurasi pin lcd
#include <Wire.h>// library i2c
#include <SPI.h>// spi library
#include <SD.h>// sd card library
#define dataPin  8// pin konfigurasi
#define clockPin 9
SHT1x sht1x(dataPin, clockPin); // sht object
#define DS1307 0x68// alamat i2c ds1307
#define ss 10// ss pin sd card

int time_save=60; // detik jika perjam maka disi 3600// interval
penyimpanan
float suhu; // variable global
float kelembapan;
unsigned char jam,menit,detik,hari,tanggal,bulan,tahun;
char
*day[]={"","Minggu","Senin","Selasa","Rabu","Kamis","Jumat","Sabtu
"};
int last_time,timer=0;

void setup()// pengaturan register
{
Wire.begin();  // i2c aktif
// atur mode lcd 16x2//setDS1307(11,54,0,7,22,7,17);
lcd.begin(16, 2);

  if (!SD.begin(ss))  // atur sd card
{
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("SDcard Error!");
  delay(1000);
  }

  lcd.clear();  // tampilan awal
  lcd.setCursor(0,0);
  lcd.print("Suhu&Kelembapan");
  lcd.setCursor(0,1);
  lcd.print("SDcard Datalog");

  delay(1000);
}

void loop()// program utama
{
semua_program(); // panggil program
}
void semua_program()
```

```
{
  suhu = sht1x.readTemperatureC();  // baca suhu dan kelembapan
  kelembapan = sht1x.readHumidity();  // baca rtc
  readDS1307(&jam,&menit,&detik,&hari,&tanggal,&bulan,&tahun);

  lcd.clear();  // tampilkan ke lcd

  lcd.setCursor(0,0);
  lcd.write('T');
  lcd.print(suhu,1);
  lcd.write(0xdf);
  lcd.write('C');
  lcd.setCursor(9,0);
  lcd.write('H');
  lcd.print(kelembapan,1);
  lcd.write('%');
  lcd.setCursor(0,1);
  lcd.print("Time ");
  lcd.print(jam);
  lcd.write(':');
  lcd.print(menit);
  lcd.write(':');
  lcd.print(detik);
  lcd.setCursor(14,1);

  if(last_time!=detik)  // timer per detik
{
  timer++;
  last_time=detik;
  }
  if(timer>=time_save)
{
  File dataFile = SD.open("logsht.txt", FILE_WRITE);  // buat file

  if (dataFile)
 {
  dataFile.println("--------------*****-------------");// tulis ke
mikro sdc
    dataFile.print("Suhu: ");
    dataFile.print(suhu);
    dataFile.println("C");
    dataFile.print("Kelembapan: ");
    dataFile.print(kelembapan);
    dataFile.println("%");

    dataFile.print("Waktu ");
    dataFile.print(jam);
    dataFile.print(":");
    dataFile.print(menit);
    dataFile.print(":");
    dataFile.print(detik);
    dataFile.print(" ");
    dataFile.print(day[hari]);
    dataFile.print("/");
    dataFile.print(tanggal);
    dataFile.print("/");
```

```
    dataFile.print(bulan);
    dataFile.print("/");
    dataFile.println(tahun);

    dataFile.close();
    lcd.print("OK");
    delay(500);
  }
  else
{
  lcd.print("ER");
  delay(500);
  }
  timer=0;
  }
  delay(50);  // jeda loop
}

byte decToBcd(byte val) // desimal ke bcd

{
  return( (val/10*16) + (val%10) );
}
byte bcdToDec(byte val) // bcd ke desimal

{
  return( (val/16*10) + (val%16) );
}

void setDS1307(byte hour, byte minute, byte second, byte
dayOfWeek, byte dayOfMonth, byte month, byte year) {
  Wire.beginTransmission(DS1307);  // sets time and date
  Wire.write(0); // set next input to start at the seconds
register
  Wire.write(decToBcd(second)); // set detik
  Wire.write(decToBcd(minute)); // set menit
  Wire.write(decToBcd(hour)); // set jam
  Wire.write(decToBcd(dayOfWeek)); // hari (1=minggu, 7=sabtu)
  Wire.write(decToBcd(dayOfMonth)); // tanggal (1 to 31)
  Wire.write(decToBcd(month)); // bulan (1-12)
  Wire.write(decToBcd(year)); // tahun (0 to 99)
  Wire.endTransmission();
}

void readDS1307(byte *hour,byte *minute,byte *second,byte
*dayOfWeek,byte *dayOfMonth,byte *month,byte *year)
{
  Wire.beginTransmission(DS1307);
  Wire.write(0); // set 1307 register pointer to 00h
  Wire.endTransmission();
  Wire.requestFrom(DS1307, 7);
  *second = bcdToDec(Wire.read() & 0x7f);  // request seven bytes
of data from DS1307 starting from register 00h

  *minute = bcdToDec(Wire.read());
  *hour = bcdToDec(Wire.read() & 0x3f);
```

```
  *dayOfWeek = bcdToDec(Wire.read());
  *dayOfMonth = bcdToDec(Wire.read());
  *month = bcdToDec(Wire.read());
  *year = bcdToDec(Wire.read());
}
```

METODE ANALISIS DATA

1. Perhitungan Data I

a. Rata – rata

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

Dimana : $\overline{X}$ = rata-rata

$\sum$Xi = Jumlah nilai data

n = Banyak data (1,2,3,…,n)

1) Rata – rata pengukuran suhu dan kelembaban I

a) Rata-rata suhu pada modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(22.76+22.77+22.79+22.79+22.81+22.82+22.83+22.86+22.88
+22.87+22.86+22.83+22.84+22.85+22.82+22.82+22.84+22.85
+22.87+22.82)/20

=22.829

b) Rata-rata suhu pada alat pembanding

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(22.1+22+22.1+22.1+22.1+22+22+22+22.1+22.1+22+22+
22.1+22.1+22.1+22.1+22.1+22.1+22.1+22.1)/20

=22.07

c) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(64.88+64.59+64.39+64.92+64.78+64.69+64.40+64.20+63.97
+63.70+63.87+64.02+63.69+63.75+63.60+63.70+64.02+63.59
+63.70+63.54)/20

=64.1

d) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(64+64+64+64+64+63+64+64+64+63+63+64+63+63+63+63
+64+63+63+63)/20

=63.5

b. Simpangan

Simpangan = Y – $\overline{X}$

Dimana : Y = data setting

$\overline{X}$ = rata –rata hasil pengukuran

1) Simpangan suhu dan kelembaban I

a) Simpangan suhu

Simpangan = Y - $\bar{X}$

= 22.829-22.07

= 0.759

b) Simpangan kelembaban

Simpangan = Y - $\bar{X}$

= 64.1-63.5

= 0.6

c. Error %

Error = $\left(\frac{data\ setting - re\ rata}{data\ setting}\right) x\ 100\%$

1) Error suhu dan kelembaban I

a) Error suhu

Error = $\left(\frac{22.07-22.829}{22.07}\right) x\ 100\%$

= 3%

b) Error kelembaban

Error $= \left(\frac{63.5-64.1}{64.1}\right) x\ 100\%$

$= 1\%$

d. Standar deviasi

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

Dimana:

$x_i = data\ pengukuran$

$\bar{x} = Re\ rata\ hasil\ pengukuran$

n = jumlah data

1) Standar deviasi suhu dan kelembaban I

a) SD Suhu

SD = √((22.76-22.07)² + (22.77-22.07)² +(22.79-22.07)² +
(22.79-22.07)² + (22.81-22.07)² + (22.82-22.07)² + (22.83-22.07)²+
(22.86-22.07)² + (22.88-22.07)² + (22.87-22.07)² + (22.86-22.07)²+
(22.83-22.07)² + (22.84-22.07)² + (22.85-22.07)² + (22.82-22.07)²+
(22.82-22.07)² + (22.84-22.07)² + (22.85-22.07)² + (22.87-22.07)²+
(22.82-22.07)² */(20-1)*)
SD=√(11.5426/19)
SD=√(0.607)
SD =0.779

b) SD Kelembaban

SD = √((64.88-63.5)² + (64.59-63.5)² + (64.39-63.5)² + (64.92-63.5)² + (64.78-63.5)² + (64.69-63.5)² + (64.40-63.5)² + (64.20-63.5)² + (63.97-63.5)² + (63.70-63.5)² + (63.87-63.5)² + (63.02-63.5)² + (63.69-63.5)² + (63.75-63.5)² + (63.60-63.5)² + (63.70-63.5)² + (64.02-63.5)² + (63.59-63.5)² + (63.70-63.5)² + (63.54-63.5)² */(20-1)*)

SD=√(11.3924/19)

SD=√(0.5996)

SD =0.7743

e. Ketidakpastian = $\frac{stdv}{\sqrt{n}}$

Dimana :

STDV = *Standar Deviasi*

n = banyaknya data

1) Standar deviasi suhu dan kelembaban I

a) Ketidakpastian Suhu

Ua= 0.779/√20

Ua=0.174

b) Ketidakpastian Kelembaban

Ua= 0.7743/√20

Ua=0.173

2. Perhitungan Data II

a. Rata – rata

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

Dimana : $\overline{X}$ = rata-rata

$\sum$Xi = Jumlah nilai data

n = Banyak data (1,2,3,…,n)

2) Rata – rata pengukuran suhu dan kelembaban I

a) Rata-rata suhu pada modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(27.28+27.12+26.93+26.8+26.66+26.6+26.58+26.51+26.42+
26.37+26.31+26.28+26.24+26.21+26.24+26.24+26.24+26.2+
26.21+26.21)/20

=26.4825

b) Rata-rata suhu pada alat pembanding

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(26.50+26.20+26.70+26.70+26.50+26.30+26.50+26.50+26.30
+26.50+26.1+26+25.9+26+26.1+25.9+25.9+26+25.9+25.9)/20

=26.22

c) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(78.89+80.35+81.48+82.16+82.87+84.69+84.50+85.92+85.54
+86.36+87.18+86.52+85.37+85.65+86.49+86.81+86.58+87.06
+87.21+86.70)/20

=84.92

d) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(81+84+84+83+84+84+84+85+85+85+85+85+86+86+86+86
+86+86+86+86)/20

=84.85

b. Simpangan

Simpangan = Y – $\overline{X}$

Dimana : Y = data setting

$\overline{X}$ = rata –rata hasil pengukuran

2) Simpangan suhu dan kelembaban I

a) Simpangan suhu

Simpangan = Y - $\bar{X}$

= 26.4825-26.22

= 0.2625

b) Simpangan kelembaban

Simpangan = Y - $\bar{X}$

= 84.92-84.85

= 0.0665

c. Error %

Error = $\left(\frac{data\ setting - re\ rata}{data\ setting}\right) x\ 100\%$

2) Error suhu dan kelembaban I

a) Error suhu

Error = $\left(\frac{26.22-26.4825}{26.22}\right) x\ 100\%$

= 1%

c) Error kelembaban

Error $= \left(\frac{84.85-84.92}{84.85}\right) x\ 100\%$

$= 0.08\%$

d. Standar deviasi

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

Dimana:

$x_i = data\ pengukuran$

$\bar{x} = Re\ rata\ hasil\ pengukuran$

n = jumlah data

1) Standar deviasi suhu dan kelembaban I

a) SD Suhu

SD = √((27.28-26.22) ²+(27.12-26.22) ²+(26.93-26.22)²
+(26.8-26.22) ²+(26.66-26.22) ²+(26.6-26.22) ²+(26.58-26.22) ²
+(26.51-26.22) ²+(26.42-26.22) ²+(26.37-26.22) ²+(26.31-26.22) ²
+(26.28-26.22) ²+(26.24-26.22) ²+(26.21-26.22) ²+(26.24-26.22) ²
+(26.24-26.22) ²+(26.24-26.22) ²+(26.2-26.22) ²+(26.21-26.22) ²
+(26.21-26.22) ²)/(20-1))

SD=√(3.4023/19)
SD=√(0.1790)
SD =0.4230

c) SD Kelembaban

SD =√((78.89-84.85)² +(80.35-84.85)² +(81.48-84.85)² +
(82.16-84.85)² +(82.87-84.85)² +(84.69-84.85)² +(84.50-84.85)² +
(85.92-84.85)² +(85.54-84.85)² +(86.36-84.85)² +(87.18-84.85)² +
(86.52-84.85)² +(85.37-84.85)² +(85.65-84.85)² +(86.49-84.85)² +
(86.81-84.85)² +(86.58-84.85)² +(87.06-84.85)² +(87.21-84.85)² +
(86.70-84.85)²)*//(20-1)*)

SD=√(114.8423/19)

SD=√(6.0443)

SD =2.458522

e. Ketidakpastian = $\frac{stdv}{\sqrt{n}}$

Dimana :

STDV = *Standar Deviasi*

n = banyaknya data

2) Standar deviasi suhu dan kelembaban I

a) Ketidakpastian Suhu

Ua= 0.4230/√20

Ua=0.09

b) Ketidakpastian Kelembaban

Ua= 2.458522/√20

Ua=0.54

3. Perhitungan Data III

a. Rata – rata

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

Dimana : $\overline{X}$ = rata-rata

$\sum$Xi = Jumlah nilai data

n = Banyak data (1,2,3,…,n)

1. Rata – rata pengukuran suhu dan kelembaban I

a) Rata-rata suhu pada modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(44.24+44.47+44.51+44.05+44.15+ 41.53 +41.93+ 41.26+ 42.32+42.46+43.34+44.02 +44.21 +44.58+ 44.96+45.81 + 44.15+44.53+44.93+ 44.26 /20)

=43.6855

b) Rata-rata suhu pada alat pembanding

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(44.3+44.2+44.3+44.6+42.2+42.2+42.5+43.1+43.5+43.7+ 44.4+45.3+45.3+45.2+45.1+45.1+44.6+45+45.6+45.7)/20

=44.295

c) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(53.26+55.42+49.79+49.38+49.49+49.20+49.86+45.22+42.32 +41.16+41.17+41.38+41.49+41.20+41.86+41.22+41.32+41.16 +41.17+41.18)/20

=44.81

d) Rata-rata kelembaban modul TA

Rata – Rata ($\overline{X}$) = $\frac{\sum Xi}{n}$

=(52+52+52+52+52+52+49+46+43+42+42+42+42.9+42.6+42.3+42+42.7+42.40+42.1+42.8)/20

=45.78

b. Simpangan

Simpangan = Y – $\overline{X}$

Dimana : Y = data setting

$\overline{X}$ = rata –rata hasil pengukuran

1. Simpangan suhu dan kelembaban I

a) Simpangan suhu

Simpangan = Y - $\bar{X}$

= 44.295-43.6855

= 0.6095

b) Simpangan kelembaban

Simpangan = Y - $\bar{X}$

= 45.78-44.81

= 0.97

c. Error %

Error = $\left(\frac{data\ setting - re\ rata}{data\ setting}\right) x\ 100\%$

3) Error suhu dan kelembaban I

a) Error suhu

Error = $\left(\frac{44.295-43.6855}{44.295}\right) x\ 100\%$

= 1%

d) Error kelembaban

Error $= \left(\frac{45.78-44.81}{45.78}\right) x\ 100\%$

$= 2.113\%$

d. Standar deviasi

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

Dimana:

$x_i = data\ pengukuran$

$\bar{x} = Re\ rata\ hasil\ pengukuran$

n = jumlah data

1) Standar deviasi suhu dan kelembaban I

a) SD Suhu

SD = √((44.24-44.295) ²+ (44.47-44.295) ²+ (44.51-44.295) ²+ (44.05-44.295) ²+ (42.15-44.295) ²+ (41.53-44.295) ²+ (41.93-44.295) ²+ (41.26-44.295) ²+ (42.32-44.295) ²+ (42.46-44.295) ²+ (43.34-44.295) ²+ (44.02-44.295) ²+ (44.21-44.295) ²+ (44.58-44.295) ²+ (44.96-44.295) ²+ (45.81-44.295) ²+ (44.15-44.295) ²+ (44.53-44.295) ²+ (44.93-44.295) ²+ (44.26-44.295) ²+ / (20-1))

SD=√(38.8751/19)

SD=√(2.046)

SD =1.43

d) SD Kelembaban

SD=√((53.26-47.74) ² +(53.42-47.74) ² +(49.79-47.74) ² +
(49.38-47.74) ² +(49.49-47.74) ² +(49.20-47.74) ² +(49.86-47.74) ² +
(45.22-47.74) ² +(42.32-47.74) ² +(41.16-47.74) ² +(41.17-47.74) ² +
(41.38-47.74) ² +(41.49-47.74) ² +(41.20-47.74) ² +(41.86-47.74) ² +
(41.22-47.74) ² +(41.32-47.74) ² +(41.16-47.74) ² +(41.17-47.74) ² +
(41.18-47.74) ²)*/(20-1)*)

SD=√(419.2863/19)

SD=√(22.06)

SD =4.697

e. Ketidakpastian = $\frac{stdv}{\sqrt{n}}$

Dimana :

STDV = *Standar Deviasi*

n = banyaknya data

3) Standar deviasi suhu dan kelembaban I

a) Ketidakpastian Suhu

Ua= 1.43/√20

Ua=0.076

b) Ketidakpastian Kelembaban

Ua= 4.697/√20

Ua=1.05