Lampiran

PROGRAM

```
#include <SD.h>
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_MLX90614.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd(A3, A2, A1, 5, 6, 7);
#include <Wire.h>
#include "RTClib.h"

RTC_DS1307 rtc;
char namaHari[7][12] = {"Minggu", "Senin", "Selasa",
"Rabu", "Kamis", "Jumat", "Sabtu"};

Adafruit_MLX90614 mlx = Adafruit_MLX90614();

int t_memori = 3;
int t_scan = 2;
int t_lampu = 9;
int lamp = 8;
int buzz = 4;
int cs = 10;
int batt = A0;
File myFile;

float R1 = 100000;
float R2 = 10000;
int awal = 1;
int simpan = 0;
int x = 0;
float suhu, rawsuhu;
float value;
```

```
byte address;
byte alamat;
int ke = 1, to = 1;
float adcMin = 1.8;
float adcMax = 2.5;

void setup() {
  Serial.begin(9600);
  mlx.begin();
  lcd.begin(8, 2);

  pinMode(cs,OUTPUT);
  pinMode(buzz, OUTPUT);
  pinMode(lamp, OUTPUT);
  pinMode(t_memori, INPUT);
  pinMode(t_scan, INPUT);
  pinMode(t_lampu, INPUT);
  digitalWrite(t_memori, HIGH);
  digitalWrite(t_scan, HIGH);
  digitalWrite(t_lampu, HIGH);

  lcd.setCursor(0, 0);
  lcd.print("THERMO  ");
  lcd.setCursor(0, 1);
  lcd.print("DIGITAL ");
  delay(2000);
  lcd.clear();

  lcd.print("Setup     ");
  lcd.setCursor(0,1);
  lcd.print("microSD   ");
  delay(2000);
  lcd.clear();
  if (!SD.begin(10)) {
    lcd.print("microSD ");
    lcd.setCursor(0,1);
    lcd.print("Gagal!  ");
    while(1);
  }
```

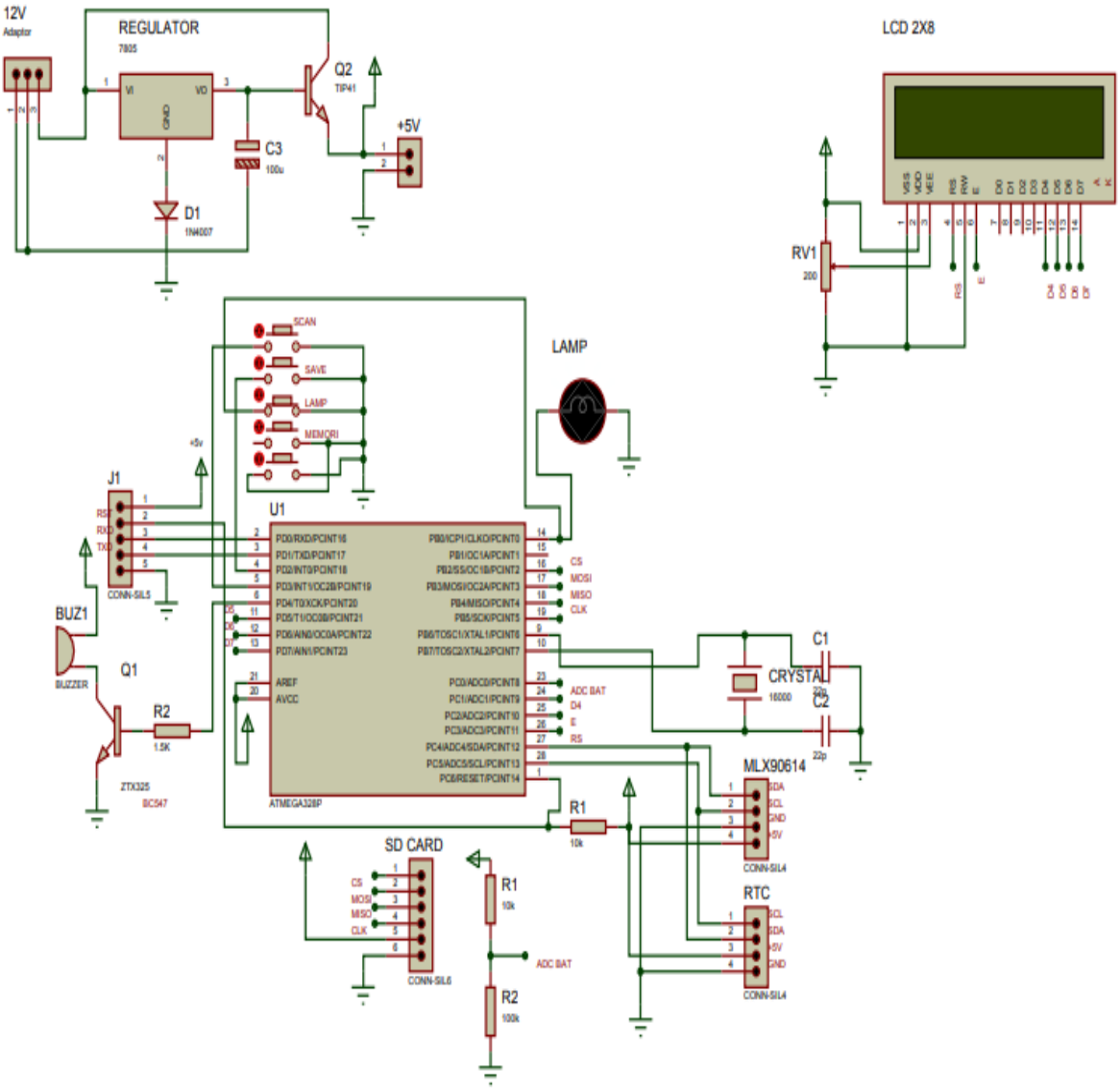
```
lcd.print("microSD   ");
 lcd.setCursor(0,1);
  lcd.print("Berhasil! ");

  delay(2000);
  lcd.clear();
}
void loop() {
  DateTime now = rtc.now();
  if (awal == 1) {
    int adcbatt = analogRead(batt);
    float vout = (adcbatt * 3.7) / 1023;
    float vin = vout / (R2/(R1+R2));
    int percent = map(vin, adcMin, adcMax, 10, 100);
    lcd.setCursor(0, 0);
    lcd.print("Bat ");
    lcd.print(percent);
    lcd.print("% ");
    lcd.setCursor(0, 1);
    lcd.print("Scan?   ");
    if (digitalRead(t_scan) == LOW) {
      while (!digitalRead(t_scan)) {
      }
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Scanning");
      delay(1000);
      for (int i = 0; i < 8; i++) {
        suhu = mlx.readObjectTempC();
        lcd.setCursor(i, 1);
        lcd.print(char(255));
        if (i == 0) {
          digitalWrite(buzz, HIGH);
          delay(100);
          digitalWrite(buzz, LOW);
        }
if (i == 7) {
```

```
    digitalWrite(buzz, HIGH);
          delay(500);
          digitalWrite(buzz, LOW);
        }
        delay(1000);
lcd.clear();
      delay(500);
      if (suhu <= 31.9 || suhu >= 43) {
        lcd.setCursor(0, 0);
        lcd.print("Error! ");
      }
      else {
        lcd.setCursor(0, 0);
        lcd.print("Suhu : ");
        lcd.setCursor(0, 1);
        lcd.print(suhu, 1);
        lcd.print(char(223));
        lcd.print("C  ");
      }
      digitalWrite(buzz, HIGH);
      delay(100);
      digitalWrite(buzz, LOW);
      delay(1000);
lcd.clear();
      awal = 0;
      simpan = 1;
    }
  }
  if (simpan == 1) {
    lcd.setCursor(0, 0);
    lcd.print("Simpan? ");
    lcd.setCursor(0, 1);
    lcd.print(suhu, 1);
    lcd.print(char(223));
    lcd.print("C  ");
      }
    if (digitalRead(t_memori) == LOW) {
```

```
      while (!digitalRead(t_memori)) {
      if (ke < 1000) {
        lcd.clear();
        delay(500);
        lcd.print("Data ");
        lcd.print(ke);
        lcd.setCursor(0, 1);
        lcd.print(suhu, 1);
        lcd.print(char(223));
        lcd.print("C  ");
        myFile = SD.open("data.txt", FILE_WRITE);
        if (myFile) {
          myFile.print(namaHari[now.dayOfTheWeek()]);
          myFile.print(", ");
          myFile.print(now.day(), DEC);
          myFile.print('/');
          myFile.print(now.month(), DEC);
          myFile.print('/');
          myFile.print(now.year(), DEC);
          myFile.print(" ");
          myFile.print(now.hour(), DEC);
          myFile.print(':');
          myFile.print(now.minute(), DEC);
          myFile.print(':');
          myFile.print(now.second(), DEC);
          myFile.print(", ");
          myFile.print("Orang ");
          myFile.print(ke);
          myFile.print(" : ");
          myFile.print(suhu, 1);
          myFile.print("C ");
          if (suhu >= 32 && suhu <= 37.4) {
            myFile.println("(hipo)");
          }
          if (suhu >= 37.5 && suhu <= 37.9) {
            myFile.println("(normal)");
          }
          if (suhu >= 38 && suhu <= 42.9) {
            myFile.println("(hiper)");
          }
```

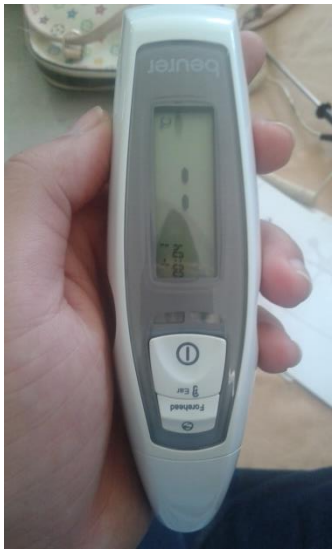
```
          myFile.close();
        }
        delay(2000);
        ke = ke + 1;
      }
      else {
        lcd.clear();
        lcd.print("Data  ");
        lcd.setCursor(0, 1);
        lcd.print("Penuh!");
        address = 0;
        delay(2000);
        lcd.clear();
      }
      awal = 1;
      simpan = 0;
    }
    if (digitalRead(t_scan) == LOW) {
      while (!digitalRead(t_scan)) {
     }
      awal = 1;
      simpan = 0;
      lcd.clear();
    }
  }
  if (digitalRead(t_lampu) == LOW  && x == 0) {
    while (!digitalRead(t_lampu)) {
    }
    digitalWrite(lamp, HIGH);
    x = 1;
  }
if (digitalRead(t_lampu) == LOW  && x == 1) {
    while (!digitalRead(t_lampu)) {
    }
    digitalWrite(lamp, LOW);
    x = 0;
  }
  Serial.println(mlx.readObjectTempC());
  delay(200);
}
```

RANGKAIAN


12V
Adaptor
REGULATOR
7805
VI
VO
GND
Q2
TIP41
+5V
C3
100u
D1
1N4007
LCD 2X8
VSS
VDD
VEE
RS
RW
E
D0
D1
D2
D3
D4
D5
D6
D7
A
K
RV1
200
SCAN
SAVE
LAMP
MEMORI
LAMP
+5v
J1
CONN-SIL5
U1
PD0/RXD/PCINT16
PD1/TXD/PCINT17
PD2/INT0/PCINT18
PD3/INT1/OC2B/PCINT19
PD4/T0/XCK/PCINT20
PD5/T1/OC0B/PCINT21
PD6/AIN0/OC0A/PCINT22
PD7/AIN1/PCINT23
AREF
AVCC
PB0/ICP1/CLKO/PCINT0
PB1/OC1A/PCINT1
PB2/SS/OC1B/PCINT2
PB3/MOSI/OC2A/PCINT3
PB4/MISO/PCINT4
PB5/SCK/PCINT5
PB6/TOSC1/XTAL1/PCINT6
PB7/TOSC2/XTAL2/PCINT7
PC0/ADC0/PCINT8
PC1/ADC1/PCINT9
PC2/ADC2/PCINT10
PC3/ADC3/PCINT11
PC4/ADC4/SDA/PCINT12
PC5/ADC5/SCL/PCINT13
PC6/RESET/PCINT14
ATMEGA328P
CS
MOSI
MISO
CLK
ADC BAT
D4
E
RS
BUZ1
BUZZER
Q1
ZTX325
BC547
R2
1.5K
C1
CRYSTAL
16000
22p
C2
22p
R1
10k
MLX90614
SDA
SCL
GND
+5V
CONN-SIL4
RTC
SCL
SDA
+5V
GND
CONN-SIL4
SD CARD
CS
MOSI
MISO
CLK
CONN-SIL6
R1
10k
ADC BAT
R2
100k

PENGAMBILAN DATA

Suhu Ruang

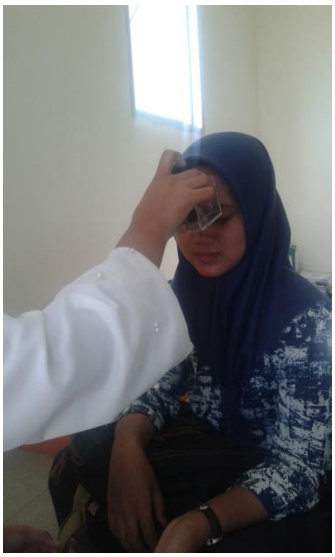


Alat Pembanding

Pengambilan Data Dahi Responden

Pengambilan Data Telinga Kanan Responden

Pengambilan Data Telinga Kiri Responden



Pengambilan Data Dahi Responden

PERHITUNGAN

1. Pengukuran pada anak-anak usia (0-12 tahun)

a. Telinga Kanan

- **Rata-rata suhu Thermomether Pembanding**

$$Y' = 36.63$$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{36{,}7+36+36{,}9+36{,}7+36{,}1+36{,}2+36{,}4+36{,}4+36{,}4+36{,}3}{10}$$

$$= 36{,}41$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 + X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$= \sqrt{\frac{\begin{matrix}(36{,}7 - 36{,}63)^2 + (36 - 36{,}63)^2 + (36{,}9 - 36{,}63)^2 + (36{,}7 - 36{,}63)^2 + (36{,}1 - 36{,}63)^2 \\ (36{,}2 - 36{,}63)^2 + (36{,}4 - 36{,}63)^2 + (36{,}4 - 36{,}63)^2 + (36{,}4 - 36{,}63)^2 \\ +(36{,}3 - 36{,}63)^2\end{matrix}}{10 - 1}}$$

$$= 0.28$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}63 - 36{,}41}{36.63} x100\%$$

$$= 0{,}6\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0.09

b. Telinga Kiri

- **Rata-rata suhu Thermomether Pembanding**

$$Y' = 36{,}47$$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{36.5+36{,}3+36{,}1+36{,}6+37+36+36{,}3+36{,}1+36{,}2+36}{10}$$

$$= 36{,}31$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 + X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$= \sqrt{\frac{\begin{matrix}(36{,}5 - 36{,}31)^2 + (36{,}3 - 36{,}61)^2 + (36{,}1 - 36{,}61)^2 + (36{,}6 - 36{,}61)^2 \\ +(37 - 36{,}61)^2 + (36 - 36{,}61)^2 + (36{,}3 - 36{,}61)^2 + (36{,}1 - 36{,}61)^2 \\ +(36{,}2 - 36{,}61)^2 + (36 - 36{,}61)^2\end{matrix}}{10 - 1}}$$

$$= 0{,}31$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}47 - 36{,}31}{36{,}47} x100\%$$

$$= 0{,}4\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0,09

2. Pengukuran pada Remaja (12-25 tahun)

a. Telinga Kanan

- **Rata-rata suhu Thermomether Pembanding**

$$Y' = 36{,}77$$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{37+36{,}9+36{,}2+37+36{,}7+36{,}2+36+36{,}1+36{,}5+36}{10}$$

$$= 36{,}46$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 + X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$= \sqrt{\frac{\begin{matrix}(37 - 36{,}46)^2 + (36{,}9 - 36{,}46)^2 + (36{,}2 - 36{,}46)^2 + (37 - 36{,}46)^2 + (36{,}7 - 36{,}46)^2 \\ (36{,}2 - 36{,}46)^2 + (36 - 36{,}46)^2 + (36{,}1 - 36{,}46)^2 + (36{,}5 - 36{,}46)^2 \\ +(36 - 36{,}46)^2\end{matrix}}{10 - 1}}$$

$$= 0.41$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}77 - 36{,}46}{36.77} x100\%$$

$$= 0{,}8\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0.13

b. Telinga Kiri

- **Rata-rata suhu Thermomether Pembanding**

$$Y' = 36{,}65$$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{36.9-36{,}1-36{,}1-36-36{,}1-36{,}6-36{,}2-36{,}5-36{,}3-36{,}5}{10}$$

$$= 36{,}33$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 + X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$== \sqrt{\frac{\begin{matrix}(36{,}9 - 36{,}33)^2 + (36{,}1 - 36{,}33)^2 + (36{,}1 - 36{,}33)^2 + (36 - 36{,}33)^2 + (36{,}1 - 36{,}33)^2 \\ (36{,}6 - 36{,}33)^2 + (36{,}2 - 36{,}33)^2 + (36{,}5 - 36{,}33)^2 + (36{,}3 - 36{,}33)^2 \\ +(36{,}5 - 36{,}33)^2\end{matrix}}{10 - 1}}$$

$$= 0{,}2$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}65 - 36{,}33}{36{,}65} x100\%$$

$$= 0{,}8\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0,09

3. Pengukuran pada Dewasa (25-45 tahun)

3.2.a.1 Telinga Kanan

- **Rata-rata suhu Thermomether Alat Pembanding**

$$Y' = 36{,}74$$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{36{,}3+36{,}8+36{,}7+36{,}4+36{,}4+36{,}7+36{,}6+36{,}3+36{,}8+36{,}5}{10}$$

$$= 36{,}55$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 - X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$== \sqrt{\frac{\begin{matrix}(36{,}3 - 36{,}55)^2 + (36{,}8 - 36{,}55)^2 + (36{,}7 - 36{,}55)^2 + (36{,}4 - 36{,}55)^2 + (36{,}7 - 36{,}55)^2 \\ (36{,}6 - 36{,}55)^2 + (36{,}3 - 36{,}55)^2 + (36{,}4 - 36{,}55)^2 + (36{,}8 - 36{,}55)^2 \\ +(36{,}5 - 36{,}55)^2\end{matrix}}{10 - 1}}$$

$$= 0.19$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}74 - 36{,}55}{36{,}74} x100\%$$

$$= 0{,}5\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0,06

3.2.a.2 Telinga Kiri

- **Rata-rata suhu Thermomether Alat Pembanding**

$Y' = 36{,}81$

- **Rata-rata suhu alat**

$$X' = \frac{X1 + X2 + X3 + X4 + X5 + \cdots + X10}{10}$$

$$= \frac{36{,}5+36{,}9+36{,}5+36{,}3+36{,}7+36{,}5+36{,}3+36{,}5+36{,}3+36{,}1}{10}$$

$$= 36{,}46$$

- **Standart Deviasi**

$$STDV = \sqrt{\frac{(X1 - X')^2 + (X2 - X')^2 + (X3 - X')^2 + \cdots + (X10 - X')^2}{n - 1}}$$

$$== \sqrt{\frac{\begin{matrix}(36{,}5 - 36{,}46)^2 + (36{,}9 - 36{,}46)^2 + (36{,}5 - 36{,}46)^2 + (36{,}3 - 36{,}46)^2 + (36{,}7 - 36{,}46)^2 \\ (36{,}5 - 36{,}46)^2 + (36{,}3 - 36{,}46)^2 + (36{,}5 - 36{,}46)^2 + (36{,}3 - 36{,}46)^2 \\ +(36{,}1 - 36{,}46)^2\end{matrix}}{10 - 1}}$$

$$= 0.2$$

- **Persen Error**

$$Error\% = \frac{Y' - X'}{Y'} x100\%$$

$$= \frac{36{,}81 - 36{,}46}{36{,}81} x100\%$$

$$= 0{,}9\%$$

- **Ketidakpastian**

$$Ua = \frac{STDEV}{\sqrt{n}}$$

= 0.07