LAMPIRAN A

SCRIPT PERANGKAT KERAS SUB-SISTEM *MONITORING*

```
#include "ACS712.h"
#include <Wire.h>
#include <BH1750.h>
#include "ThingSpeak.h"
#include "WiFiEsp.h"
#include "EmonLib.h"



char ssid[] = "Nokia 5";   // your network SSID (name)
char pass[] = "123456679";   // your network password
int keyIndex = 0;            // your network key Index number (needed only for WEP)
WiFiEspClient  client;


unsigned long myChannelNumber_A = 963003;
const char * myWriteAPIKey_A = "T3U5VL0TBE9QCZRE";


unsigned long myChannelNumber_B = 964249 ;
const char * myWriteAPIKey_B = "K1EOTK98IDEB3ZIX";



#ifndef HAVE_HWSERIAL1
#include "SoftwareSerial.h"
SoftwareSerial Serial1(19, 18); // RX, TX
```

```
#define ESP_BAUDRATE  19200
#else
#define ESP_BAUDRATE  115200
#endif


// sensor ZMPT101B dihubungkan dengan pin A0
EnergyMonitor emon1;             // Create an instance


// Sensor ACS712_20A pada plta dihubungkan dengan pin A7
// Sensor ACS712_20A pada pltb dihubungkan dengan pin A8
// Sensor ACS712_20A pada plts dihubungkan dengan pin A5
// Sensor ACS712_20A pada aki dihubungkan dengan pin A6
// Sensor ACS712_20A pada keluaran ac dihubungkan dengan pin A9


ACS712 currentSensorplta(ACS712_20A, A7);
ACS712 currentSensorpltb(ACS712_20A, A6);
ACS712 currentSensorplts(ACS712_20A, A9);
ACS712 currentSensorac(ACS712_20A, A5);


//sensor pembagi tegangan pada PLTA
int analogInputplta = A3;
float voutplta = 0.0;
float vinplta = 0.0;
float R1 = 6200.0; //
float R2 = 24000.0; //
int valueplta = 0;
```

```
//sensor pembagi tegangan pada PLTB
int analogInputpltb = A2;
float voutpltb = 0.0;
float vinpltb = 0.0;
float R3 = 36000.0; //
float R4 = 51000.0; //
int valuepltb = 0;

//sensor pembagi tegangan pada PLTS
int analogInputplts = A1;
float voutplts = 0.0;
float vinplts = 0.0;
float R5 = 6800.0; //
float R6 = 24000.0; //
int valueplts = 0;

//sensor pembagi tegangan pada aki
int analogInputaki = A4;
float voutaki = 0.0;
float vinaki = 0.0;
float R7 = 12000.0; //
float R8 = 36000.0; //
int valueaki = 0;

//sensor pembacaan intensitas cahaya
BH1750 lightMeter;
```

```
// sensor pembacaan debit air
volatile int flow_frequency; // menghitung pulsa
float l_hour; // hitung liter/jam
unsigned char flowsensor = 3; // inputan Sensor
unsigned long currentTime;
unsigned long cloopTime;
void flow () // fungsi interrupt
{
   flow_frequency++;
}


// sensor anemometer
# define windPin 2 //Menerima data data dari sensor
// definisi konstanta
const float pi = 3.14159265; // nilai pi
int period = 1000; // perhitungan periode (milisecond)
int radio = 90; // jarak antara pusat windmill ke outer cup (mm)
int jml_celah = 18; // jumlah celah sensor
// Definisi variabel
unsigned int Sample = 0; // nilai sampel
unsigned int counter = 0; // B/W counter dari sensor
unsigned int RPM = 0; // Revolutions per minute
float speedwind = 0; // kecepatan angin (m/s)


void setup()
{
  Serial.begin(9600);
```

```
 setEspBaudRate(ESP_BAUDRATE);
delay (100);
// calibrate() metode kalibrasi zero point pada sensor
// Pastikan arus tidak ada yang mengalir
//Serial.println("Mengkalibrasi....Pastikan tidak ada arus yang mengalir");
//delay(100);
emon1.voltage(A0, 600, 1.7);  // Voltage: input pin, calibration, phase_shift

currentSensorplta.calibrate();
 currentSensorpltb.calibrate();
  currentSensorplts.calibrate();
    currentSensorac.calibrate();
//Serial.println("Selesai!");

pinMode(analogInputplta, INPUT);
pinMode(analogInputpltb, INPUT);
pinMode(analogInputplts, INPUT);
pinMode(analogInputaki, INPUT);

Wire.begin();

lightMeter.begin();

pinMode(flowsensor, INPUT);
digitalWrite(flowsensor, HIGH); // Optional Internal Pull-Up
Serial.begin(9600);
attachInterrupt(0, flow, RISING); // Setup Interrupt
```

```
  sei(); // Enable interrupts
  currentTime = millis();
  cloopTime = currentTime;


   while (!Serial) {
    ; // wait for serial port to connect. Needed for Leonardo native USB port only
  }


  Serial.print("Searching for ESP8266...");
  // initialize ESP module
  WiFi.init(&Serial1);


  // check for the presence of the shield
  if (WiFi.status() == WL_NO_SHIELD) {
    Serial.println("WiFi shield not present");
    // don't continue
    while (true);
  }
  Serial.println("found it!");
    ThingSpeak.begin(client);  // Initialize ThingSpeak
}


void loop()
{


  // Connect or reconnect to WiFi
  if(WiFi.status() != WL_CONNECTED){
```

```
  Serial.print("Attempting to connect to SSID: ");
  Serial.println(ssid);
  while(WiFi.status() != WL_CONNECTED){
    WiFi.begin(ssid, pass);  // Connect to WPA/WPA2 network. Change this line if using open or WEP network
    Serial.print(".");
    delay(3000);
  }
  Serial.println("\nConnected.");
 }


 emon1.calcVI(20,2000);        // Calculate all. No.of half wavelengths (crossings), time-out
 float U   = emon1.Vrms;            //extract Vrms into Variable
 Serial.println(U);


 delay(1000);
 float Iplta = currentSensorplta.getCurrentDC();
 float Ipltb = currentSensorpltb.getCurrentDC();
 float Iplts = currentSensorplts.getCurrentDC();
 float Iac = currentSensorac.getCurrentAC();


 // Menghitung daya listrik yang digunakan
 float Pplta = vinplta * Iplta;
 float Ppltb = vinpltb*1.74 * Iplts*3;
 float Pplts = vinplts * Iplts;


 delay(1000);
```

```
  // membaca nilai pada input analog PLTA
valueplta = analogRead(analogInputplta);
voutplta = (valueplta * 5.0) / 1024.0;
vinplta = voutplta / (R1/(R1+R2));

  // membaca nilai pada input analog PLTB
valuepltb = analogRead(analogInputpltb);
voutpltb = (valuepltb * 5.0) / 1024.0;
vinpltb = voutpltb / (R3/(R3+R4));

  // membaca nilai pada input analog PLTS
valueplts = analogRead(analogInputplts);
voutplts = (valueplts * 5.0) / 1024.0;
vinplts = voutplts / (R5/(R5+R6));

  // membaca nilai pada input analog aki
valueaki = analogRead(analogInputaki);
voutaki = (valueaki * 5.0) / 1024.0;
vinaki = voutaki / (R7/(R7+R8));

//membaca nilai pada sensor BH1750
float lux = lightMeter.readLightLevel();

//membaca nilai pada sensor flowmeter
currentTime = millis();
   // hitung dan print liter/jam setiap detik
```

```
  if(currentTime >= (cloopTime + 1000))
  {
    cloopTime = currentTime; // Updates cloopTime
    // frekuensi pulsa (Hz) = 7.5Q, Q adalah nilai aliran dalam L/min
    l_hour = (flow_frequency * 1 / 7.5); // (frekuensi pulsa x 60 min) / 7.5Q = flowrate dalam L/jam
    flow_frequency = 0; // Reset Counter
    Serial.print("Debit air: " );
    Serial.print(l_hour,3 ); // tampilkan liter/jam
    Serial.println(" Liter/menit");
  }


Serial.print("INPUT V AC= ");
Serial.print(U,2);
Serial.println(" Volt");


Serial.print("INPUT V PLTA= ");
Serial.print(vinplta,2);
Serial.println(" Volt");


Serial.print("INPUT V PLTB= ");
Serial.print(vinpltb,2);
Serial.println(" Volt");


Serial.print("INPUT V PLTS= ");
Serial.print(vinplts,2);
Serial.println(" Volt");
```

```
Serial.print("INPUT V aki= ");
Serial.print(vinaki,2);
Serial.println(" Volt");

Serial.print("Arus Beban= ");
Serial.print(Iac,2);
Serial.println(" Ampere");

Serial.print("Arus PLTA= ");
Serial.print(Iplta,2);
Serial.println(" Ampere");

Serial.print("Arus PLTB= ");
Serial.print(Ipltb,2);
Serial.println(" Ampere");

Serial.print("Arus PLTS= ");
Serial.print(Iplts,2);
Serial.println(" Ampere");

Serial.print("Daya PLTA= ");
Serial.print(Pplta,2);
Serial.println(" Watt");

Serial.print("Daya PLTB= ");
```

```
Serial.print(Ppltb,2);
Serial.println(" Watt");


Serial.print("Daya PLTS= ");
Serial.print(Pplts,2);
Serial.println(" Watt");


Serial.print("Light: ");
Serial.print(lux);
Serial.println(" luxmeter");



//pembacaan sensor anemometer
int sensorValue = analogRead(2);
 // print out nilai yang telah terbaca:
Serial.println(sensorValue);
Serial.print(Sample);
//Serial.print(": Mulai perhitungan...");
windvelocity();
//Serial.println(" Selesai.");
//Serial.print("Counter: ");
Serial.print(counter);
Serial.print("; RPM: ");
hitungRPM();
Serial.print(RPM);
Serial.print("; Kecepatan angin: ");
WindSpeed();
```

```
Serial.print(speedwind);
Serial.print(" [m/s]");
Serial.println();
delay(1000);


  // set the fields with the values
ThingSpeak.setField(1, String(Pplta,2));
ThingSpeak.setField(2, String(Ppltb,2));
ThingSpeak.setField(3, String(Pplts,2));
ThingSpeak.setField(4, String(vinplts,2));
ThingSpeak.setField(5, String(Iplts,2));
ThingSpeak.setField(6, String(lux,2));
ThingSpeak.setField(7, String(U,2));
ThingSpeak.setField(8, String(Iac,2));


          // write to the ThingSpeak channel
  int x = ThingSpeak.writeFields(myChannelNumber_A, myWriteAPIKey_A);
  if(x == 200){
        Serial.println("Channel update successful.");
  }
  else{
    Serial.println("Problem updating channel. HTTP error code " + String(x));
  }
  delay(6000);


ThingSpeak.setField(1, String(vinplta,2));
ThingSpeak.setField(2, String(Iplta,2));
```

```
ThingSpeak.setField(3, String(l_hour,2));
ThingSpeak.setField(4, String(vinpltb,2));
ThingSpeak.setField(5, String(Ipltb,2));
ThingSpeak.setField(6, String(speedwind,2));
ThingSpeak.setField(7, String(vinaki,2));


    int z = ThingSpeak.writeFields(myChannelNumber_B, myWriteAPIKey_B);
 if(z == 200){
   Serial.println("Channel update successful.");
 }
 else{
   Serial.println("Problem updating channel. HTTP error code " + String(z));
 }
   delay(6000);
}


// hitung kecepatan angin
void windvelocity()
{
speedwind = 0;
counter = 0;
attachInterrupt(0, addcount, CHANGE);
unsigned long millis();
long startTime = millis();
while(millis() < startTime + period) {}
detachInterrupt(1);
}
```

```
void hitungRPM()

{

RPM=((counter/jml_celah)*60)/(period/1000)*0.54; // Hitung revolutions per minute (RPM)

}

void WindSpeed()

{

speedwind = (((2 * pi * radio * RPM)/60) / 1000)*2.438518; // Hitung kecepatan angin berdasarkan m/s

}

void addcount()

{

counter++;

}


void setEspBaudRate(unsigned long baudrate){

  long rates[6] = {115200,74880,57600,38400,19200,9600};


  Serial.print("Setting ESP8266 baudrate to ");

  Serial.print(baudrate);

  Serial.println("...");


  for(int i = 0; i < 6; i++){

    Serial1.begin(rates[i]);

    delay(100);

    Serial1.print("AT+UART_DEF=");

    Serial1.print(baudrate);

    Serial1.print(",8,1,0,0\r\n");
```

```
    delay(100);
  }


  Serial1.begin(baudrate);
}
```

LAMPIRAN B

SCRIPT PERANGKAT KERAS SUB-SISTEM TAMBAHAN : *ATS*

```
#include "DS3231_Simple.h"
#include <Wire.h>
DS3231_Simple Clock;


void setup() {
  Serial.begin(9600);
  Clock.begin();
}


void loop() {
  DateTime waktu;
  waktu = Clock.read();
   if ((Clock.read() >= 18) || (Clock.read() < 20)) {    // kondisi pukul 18 - 6
   // digitalWrite(pinRelay, HIGH);                  // relay HIGH, lampu nyala
    Serial.print("Lampu nyala");                 // #debug
  } else {
    //digitalWrite(pinRelay, LOW);                 // relay LOW, lampu mati
    Serial.print("Lampu mati");                // #debug
  }



  Serial.print(waktu.Day);
  Serial.print("/");
```

```
Serial.print(waktu.Month);
Serial.print("/");
Serial.print(waktu.Year);
Serial.print(" ");
Serial.print(waktu.Hour);
Serial.print(":");
Serial.print(waktu.Minute);
Serial.print(":");
Serial.println(waktu.Second);


delay(1000);
```

LAMPIRAN C
RINCIAN DATA PENGUJIAN

Tabel 6.1 Hasil Pembacaan Tegangan, Arus dan Daya Bangkit

Volume (liter)	Waktu (detik)	Tegangan (V)	Arus (A)	Daya(W)
1	3.76	5.46	0.05	0.273
2	7.57	6.24	0.16	0.9984
3	11.07	8.45	0.18	1.521
4	15.29	8.43	0.19	1.6017
5	18.43	8.78	0.28	2.4584
6	22.36	9.08	0.39	3.5412
7	25.88	9.1	0.51	4.641
8	29.92	9.82	0.62	6.0884
9	33.34	10.17	0.61	6.2037
10	37.12	10.09	0.75	7.5675

Tabel 6.2 Hasil Pembacaan Volume terhadap Tegangan

Volume(liter)	Tegangan(V)
1	5.46
2	6.24
3	8.45
4	8.43
5	8.78
6	9.08
7	9.1
8	9.82
9	10.17
10	10.09

Tabel 6.3 Hasil Pembacaan Volume terhadap Arus

Volume (liter)	Arus (A)
1	0.05
2	0.16
3	0.18
4	0.19
5	0.28
6	0.39
7	0.51
8	0.62
9	0.61
10	0.75

Tabel 6.4 Hasil Pembacaan Volume terhadap Waktu

Volume (liter)	Waktu (detik)
1	3.76
2	7.57
3	11.07
4	15.29
5	18.43
6	22.36
7	25.88
8	29.92
9	33.34
10	37.12

Tabel 6.5 Hasil Pembacaan Volume dan Waktu terhadap Debit

Volume (liter)	Waktu (menit)	Debit (L/menit)
1	0.0627	15.95745
2	0.1262	15.85205
3	0.1845	16.26016
4	0.2548	15.69653
5	0.3072	16.27781
6	0.3727	16.10018
7	0.4313	16.22875
8	0.4987	16.04278
9	0.5557	16.19676
10	0.6187	16.16379

Tabel 6.6 Hasil Pembacaan Volume terhadap Daya

Volume (liter)	Daya (W)
1	0.273
2	0.9984
3	1.521
4	1.6017
5	2.4584
6	3.5412
7	4.641
8	6.0884
9	6.2037
10	7.5675