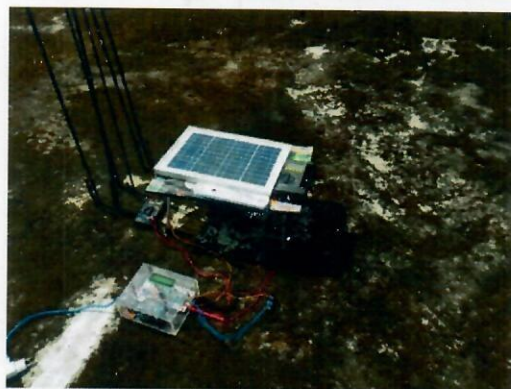
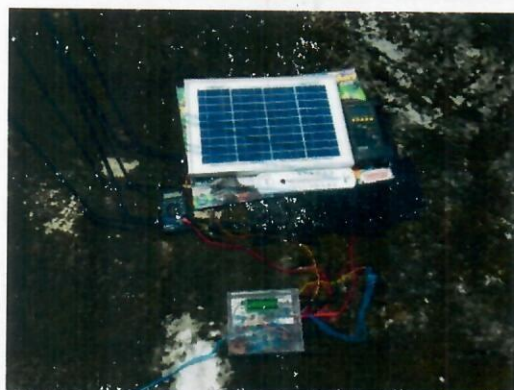
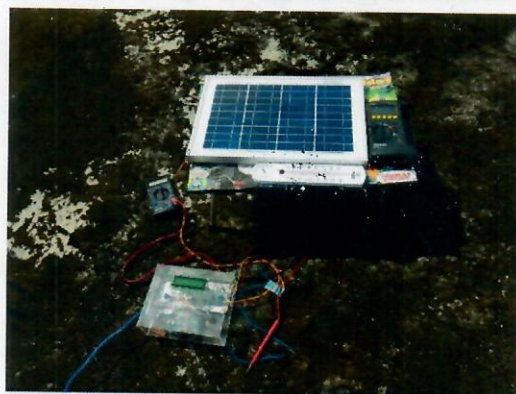
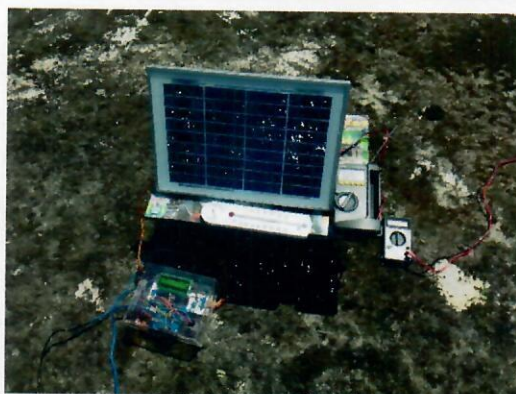
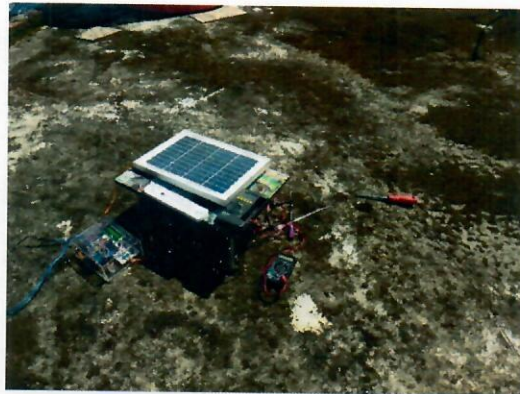


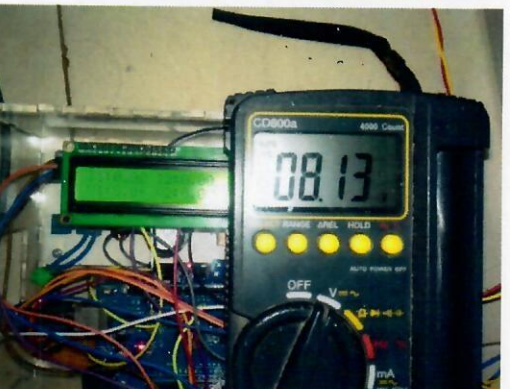
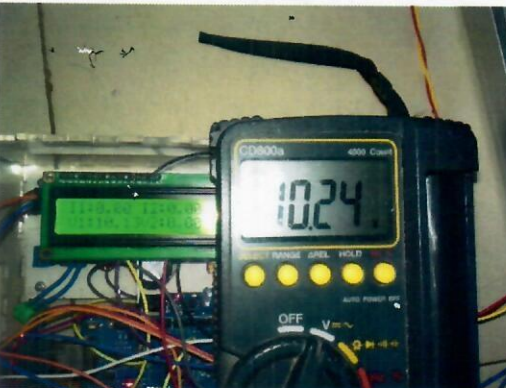
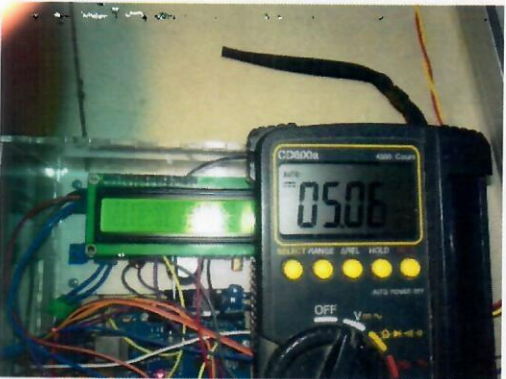
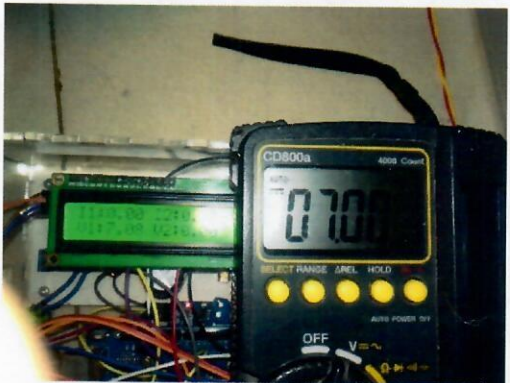
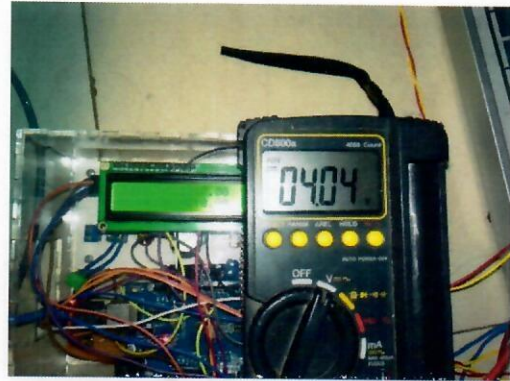
LAMPIRAN 1

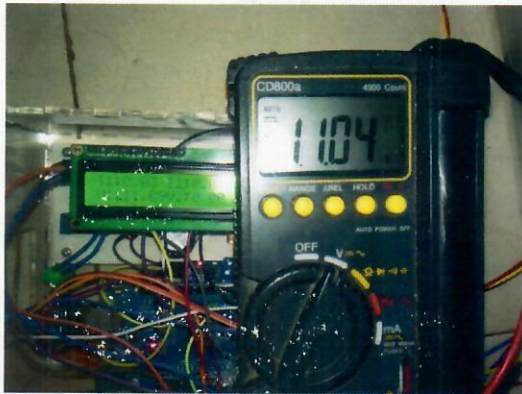
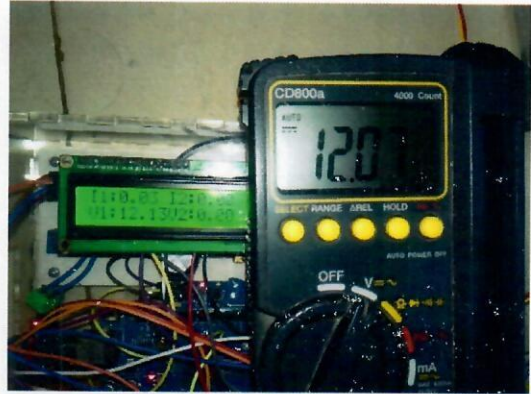
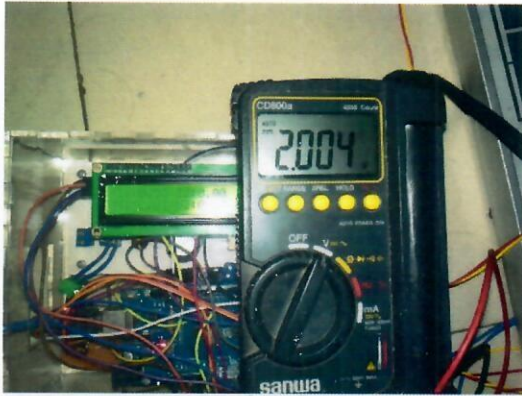
Foto Percobaan Pengambilan Data MPPT vs Non MPPT



LAMPIRAN 2

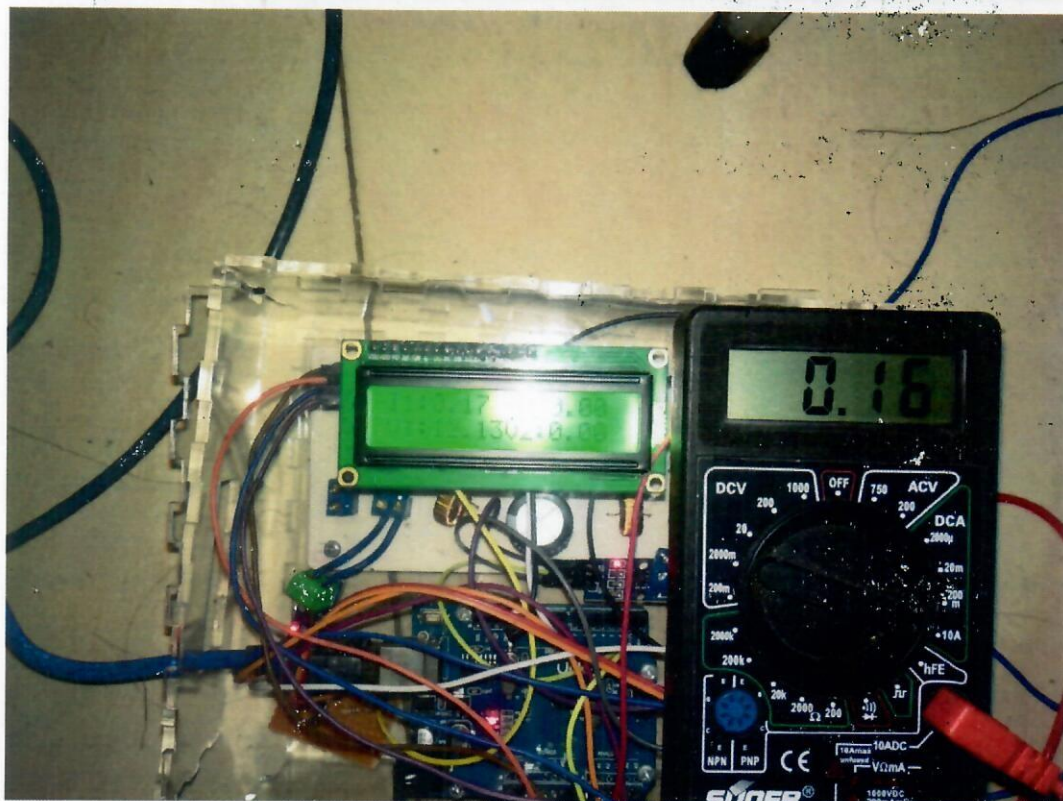
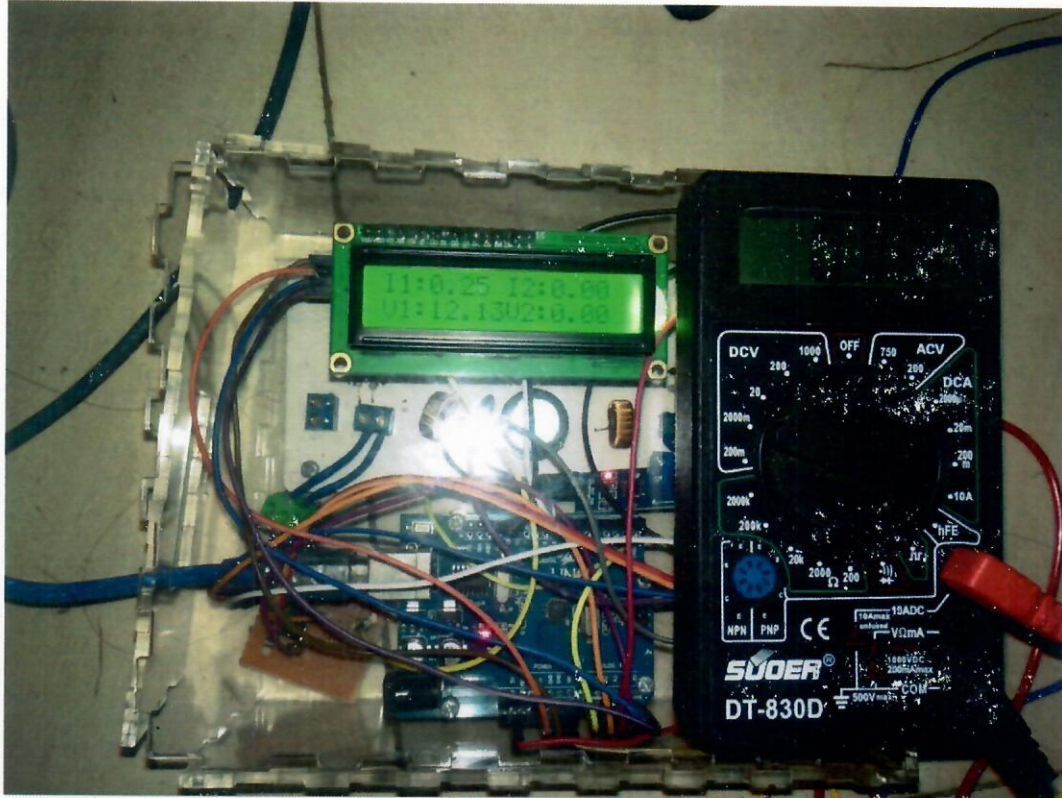
Pengujian Sensor Tegangan





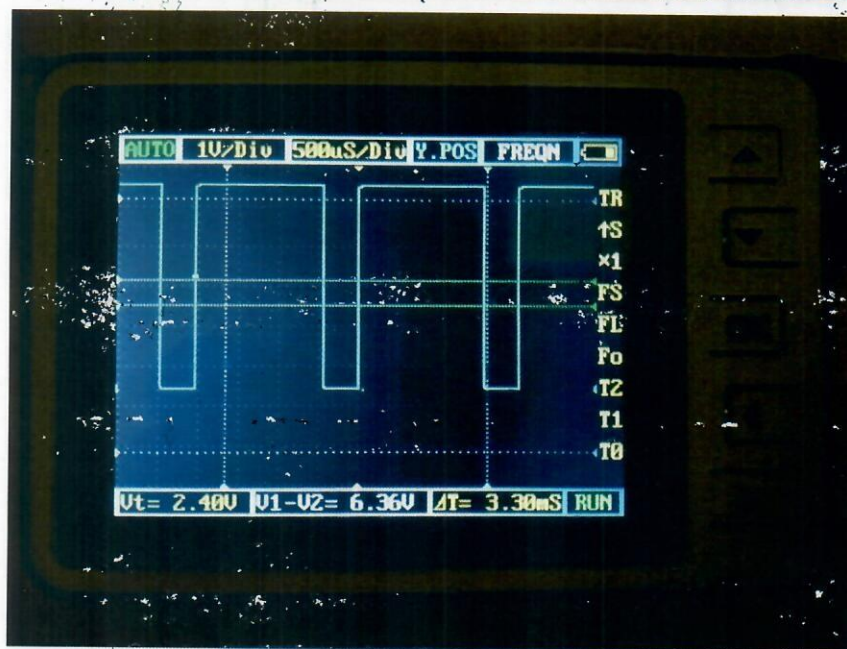
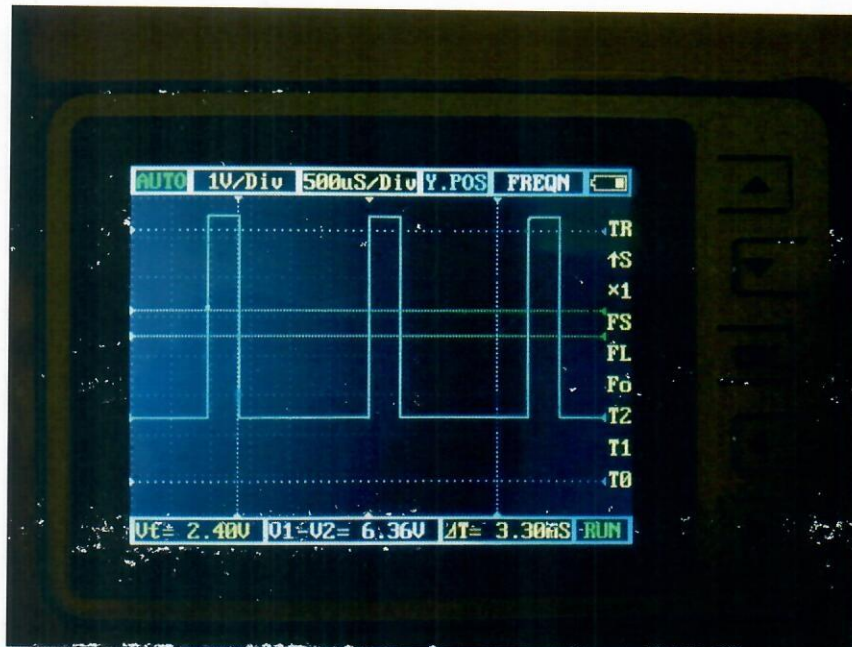
LAMPIRAN 3

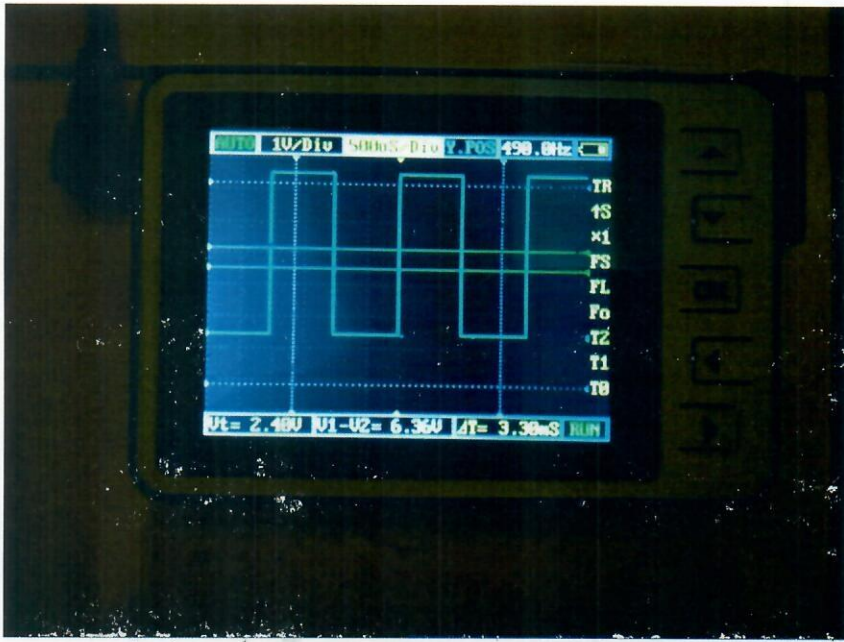
Pengujian Sensor Arus



LAMPIRAN 4

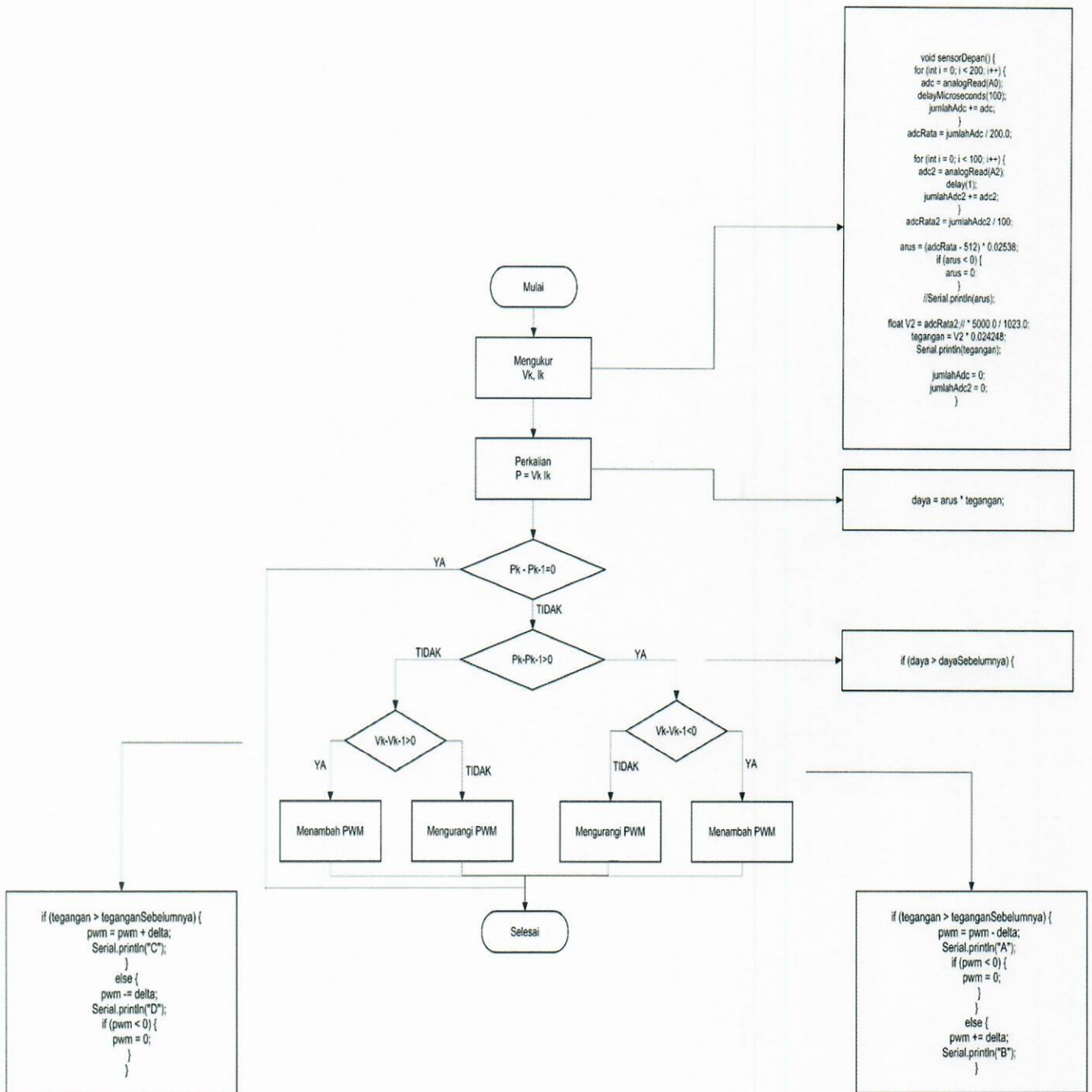
Gelombang PWM terbaca di Osiloskop





LAMPIRAN 5

Bagan Listing Program



LAMPIRAN 6

Listing Program Penuh

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2); // set the LCD address
to 0x27 for a 16 chars and 2 line display

int adc;
int adc2;
int adc3;
int adc4;
int adcSebelumnya;

int adcRata;
int adcRata2;
int adcRata3;
int adcRata4;

long jumlahAdc;
long jumlahAdc2;
long jumlahAdc3;
long jumlahAdc4;

float tegangan;
float tegangan2;
float arus;
```



```

float arus2;
int nilaipwm = 0;

int delta = 20;

float teganganSebelumnya = 20;

int pwm = 80;
float daya;
float dayaSebelumnya = 20;

void setPwmFrequencyUNO(int pin, int divisor) {
    byte mode;
    if (pin == 5 || pin == 6 || pin == 9 || pin == 10) {
        switch (divisor) {
            case 1: mode = 0x01; break;
            case 2: mode = 0x02; break;
            case 3: mode = 0x03; break;
            case 4: mode = 0x04; break;
            case 5: mode = 0x05; break;
            default: return;
        }
    }
    if (pin == 5 || pin == 6) {
        TCCR0B = TCCR0B & 0b11111000 | mode;
    } else {
        TCCR1B = TCCR1B & 0b11111000 | mode;
    }
}

```

```

} else if (pin == 3 || pin == 11) {
  switch (divisor) {
    case 1: mode = 0x01; break;
    case 2: mode = 0x02; break;
    case 3: mode = 0x03; break;
    case 4: mode = 0x04; break;
    case 5: mode = 0x05; break;
    case 6: mode = 0x06; break;
    case 7: mode = 0x07; break;
    default: return;
  }
  TCCR2B = TCCR2B & 0b11111000 | mode;
}
}

```

```

void setup() {
  lcd.init();
  // Print a message to the LCD.
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print("    MPPT");

  setPwmFrequencyUNO(9, 1);
  Serial.begin(9600);
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
}

```

```

pinMode(11, OUTPUT);
pinMode(12, OUTPUT);
Serial.println("MPPT started");

//analogReference(EXTERNAL);
delay(1000);
lcd.clear();
}

void loop() {
    // put your main code here, to run repeatedly:
    //Sensor di depan
    analogWrite(9, 0); //buat duty
    sensorDepan();
    sensorBelakang();
    tampilLCD();
    daya = arus * tegangan;
    //delay(100);
    printLengkap(); //untuk menampilkan semua hasil
    tracking();
    dayaSebelumnya = daya;
    teganganSebelumnya = tegangan;
    delay(100);
}

void sensorDepan() {
    for (int i = 0; i < 200; i++) {

```

```

        adc = analogRead(A0);
        delayMicroseconds(100);
        jumlahAdc += adc;
    }
    adcRata = jumlahAdc / 200.0;

    for (int i = 0; i < 100; i++) {
        adc2 = analogRead(A2);
        delay(1);
        jumlahAdc2 += adc2;
    }
    adcRata2 = jumlahAdc2 / 100;

    arus = (adcRata - 512) * 0.02538;
    if (arus < 0) {
        arus = 0;
    }
    //Serial.println(arus);

    float V2 = adcRata2;// * 5000.0 / 1023.0;
    tegangan = V2 * 0.024248;
    Serial.println(tegangan);

    jumlahAdc = 0;
    jumlahAdc2 = 0;
}

```

```

void sensorBelakang() {
    for (int i = 0; i < 200; i++) {
        adc3 = analogRead(A1);
        delayMicroseconds(100);
        jumlahAdc3 += adc3;
    }
    adcRata3 = jumlahAdc3 / 200.0;

    for (int i = 0; i < 100; i++) {
        adc4 = analogRead(A3);
        delay(1);
        jumlahAdc4 += adc4;
    }
    adcRata4 = jumlahAdc4 / 100;

    arus2 = (adcRata3 - 512) * 0.02538;
    if (arus2 < 0) {
        arus2 = 0;
    }
    //Serial.println(arus);

    float V2 = adcRata4;// * 5000.0 / 1023.0;
    tegangan2 = V2 * 0.049586;
    //Serial.println(tegangan);

    jumlahAdc3 = 0;
    jumlahAdc4 = 0;
}

```

```

}

void tampilLCD() {
    lcd.setCursor(0, 0);
    lcd.print("I1:");
    lcd.print(arus);

    lcd.setCursor(0, 1);
    lcd.print("V1:");
    lcd.print(tegangan*5);

    lcd.setCursor(8, 0);
    lcd.print("I2:");
    lcd.print(arus2);

    lcd.setCursor(8, 1);
    lcd.print("V2:");
    lcd.print(tegangan2);
}

void printLengkap() {
    //Serial.print("PWM : ");
    //Serial.println(nilaipwm);
    Serial.print("Arus 1 : ");
    Serial.println(arus);
    Serial.print("Tegangan 1 : ");

```

```

Serial.println(tegangan);
Serial.print("Arus 2 : ");
Serial.println(arus2);
Serial.print("Tegangan 2 : ");
Serial.println(tegangan2);
Serial.print("PWM : ");
Serial.println(pwm);
Serial.print("daya : ");
Serial.println(daya);
Serial.print("daya sebelumnya : ");
Serial.println(dayaSebelumnya);
Serial.print("Tegangan : ");
Serial.println(tegangan);
Serial.print("Tegangan sebelumnya : ");
Serial.println(teganganSebelumnya);
}

void tracking() {
  if (daya > dayaSebelumnya) {
    if (tegangan > teganganSebelumnya) {
      pwm = pwm - delta;
      Serial.println("A");
      if (pwm < 0) {
        pwm = 0;
      }
    }
  }
  else {

```

```

        pwm += delta;
        Serial.println("B");
    }
}
else {
    if (tegangan > teganganSebelumnya) {
        pwm = pwm + delta;
        Serial.println("C");
    }
    else {
        pwm -= delta;
        Serial.println("D");
        if (pwm < 0) {
            pwm = 0;
        }
    }
}
}

```

```

void printSoftware() {
    Serial.print((int)(tegangan));
    Serial.print(" ");
    Serial.println((int)(arus));
}

```