

LAMPIRAN

LAMPIRAN A DATA PENGUJIAN

Hasil Pengujian Sensor Tegangan

No	Voltmeter (V)	Sensor Tegangan 1 (V)	Sensor Tegangan 2 (V)	%Error Sensor Tegangan 1	%Error Sensor Tegangan 2
1	10	10,07	10,04	0,6951%	0,3984%
2	10,5	10,56	10,55	0,5682%	0,4739%
3	11	11,07	11,04	0,6323%	0,3623%
4	11,5	11,57	11,54	0,6050%	0,3466%
5	12	12,05	12,01	0,4149%	0,0833%
6	12,5	12,55	12,52	0,3984%	0,1597%
7	13	13,08	13,01	0,6116%	0,0769%
8	13,5	13,55	13,53	0,3690%	0,2217%
9	14	14,07	14,02	0,4975%	0,1427%
10	14,5	14,55	14,52	0,3436%	0,1377%
11	15	15,05	15,04	0,3322%	0,2660%
Rata – Rata				0,4971%	0,2427%

Hasil Pengujian Sensor Arus

No	Ampermeter (V)	Sensor Arus 1 (V)	Sensor Arus 2 (V)	%Error Sensor Arus 1	%Error Sensor Arus 2
1	5,5	5,57	5,55	1,257%	0,901%
2	6	6,05	6,07	0,826%	1,153%
3	6,5	6,55	6,57	0,763%	1,065%
4	7	7,06	7,05	0,850%	0,709%
5	7,5	7,58	7,6	1,055%	1,316%
6	8	8,1	8,12	1,235%	1,478%
7	8,5	8,59	8,58	1,048%	0,932%
8	9	9,09	9,08	0,990%	0,881%
9	9,5	9,6	9,6	1,042%	1,042%
10	10	10,1	10,12	0,990%	1,186%
Rata-rata				1,006%	1,066%

Keterangan :

PV1 : PV Bersih

PV2 : PV Kotor

Hasil Pengujian Hari ke-1 (1 Kali Pembersihan)

Tanggal	Jam	Radiasi Matahari (W/m ²)	Arus PV1 (A)	Arus PV2 (A)	Tegangan PV1 (V)	Tegangan PV2 (V)	Daya PV1 (W)	Daya PV2 (W)
12/12/2023	08:00	315	2,76	2,43	37,13	36,76	78,91	68,78
12/12/2023	09:00	533,97	3,94	3,61	36,92	36,53	112,01	101,54
12/12/2023	10:00	762,84	6,94	6,66	37,14	36,85	198,47	188,97
12/12/2023	11:00	826,21	7,59	7,06	36,9	36,52	215,65	198,53
12/12/2023	12:00	923,55	8,55	8,06	37,29	36,9	245,50	229,01
12/12/2023	13:00	904,19	8,27	7,81	37,39	37,09	238,10	223,05
12/12/2023	14:00	766,77	6,16	5,64	37,52	37,24	177,96	161,73
12/12/2023	15:00	620,95	5,1	4,22	37,52	37,21	147,34	120,91
12/12/2023	16:00	406,34	3,31	3,12	37,45	37,1	95,45	89,13
12/12/2023	17:00	190,85	0,83	0,76	35,74	35,34	22,84	20,68

Hasil Pengujian Hari ke-2 (2kali Pembersihan)

Tanggal	Jam	Radiasi Matahari (W/m ²)	Arus PV1 (A)	Arus PV2 (A)	Tegangan PV1 (V)	Tegangan PV2 (V)	Daya PV1 (W)	Daya PV2 (W)
13/12/2023	08:00	423,07	3,42	2,54	37,4	36,98	98,49	72,33
13/12/2023	09:00	672,27	4,94	3,69	37,27	36,78	141,77	104,50
13/12/2023	10:00	779,97	6,31	5,61	37,77	37,39	183,51	161,51
13/12/2023	11:00	858,05	7,67	6,97	37,81	37,47	223,30	201,10
13/12/2023	12:00	920,58	8,13	7,61	37,51	37,23	234,82	218,16
13/12/2023	13:00	941,15	8,47	7,76	37,74	37,49	246,14	224,01
13/12/2023	14:00	842,28	7,42	6,83	37,89	37,69	216,48	198,22
13/12/2023	15:00	637,08	5,57	4,97	37,61	37,45	161,31	143,32
13/12/2023	16:00	463,35	3,65	3,15	37,65	37,49	105,82	90,93
13/12/2023	17:00	192	0,85	0,77	35,61	35,49	23,31	21,04

Hasil Pengujian Hari ke-3 (3 kali Pembersihan)

Tanggal	Jam	Radiasi Matahari (W/m ²)	Arus PV1 (A)	Arus PV2 (A)	Tegangan PV1 (V)	Tegangan PV2 (V)	Daya PV1 (W)	Daya PV2 (W)
14/12/2023	08:00	438,59	3,51	2,64	37,01	36,72	100,03	74,64
14/12/2023	09:00	679,07	5,07	3,91	37,55	37,075	146,59	111,62
14/12/2023	10:00	788,57	6,61	5,87	37,65	37,23	191,63	168,28
14/12/2023	11:00	943,52	8,44	7,47	37,56	37,17	244,09	213,80

14/12/2023	12:00	983,67	9,28	7,96	37,56	37,19	268,39	227,94
14/12/2023	13:00	931,55	8,42	7,3	37,53	37,26	243,32	209,44
14/12/2023	14:00	835,01	7,33	6,09	37,74	37,55	213,01	176,08
14/12/2023	15:00	641,52	5,03	4,53	37,58	37,41	145,55	130,49
14/12/2023	16:00	242,12	1,67	1,46	37,1	36,87	47,71	41,45
14/12/2023	17:00	190,9	0,82	0,74	35,57	35,4	22,46	20,17

Hasil Pengujian Hari ke-4 (4 Kali Pembersihan)

Tanggal	Jam	Radiasi Matahari (W/m ²)	Arus PV1 (A)	Arus PV2 (A)	Tegangan PV1 (V)	Tegangan PV2 (V)	Daya PV1 (W)	Daya PV2 (W)
15/12/2023	08:00	434,78	3,5	2,68	37,48	37,04	101,01	76,44
15/12/2023	09:00	681,74	5,34	4,43	37,22	36,92	153,04	125,94
15/12/2023	10:00	790,19	6,65	5,69	37,64	37,23	192,74	163,12
15/12/2023	11:00	805,32	7,03	6,25	37,47	37,17	202,83	178,88
15/12/2023	12:00	766,8	6,14	4,94	36,96	36,67	174,74	139,49
15/12/2023	13:00	779,97	6,55	6,13	37,7	37,44	190,14	176,72
15/12/2023	14:00	870,52	7,86	7,14	37,55	37,34	227,26	205,29
15/12/2023	15:00	649,8	5,62	4,91	37,76	37,58	163,40	142,08
15/12/2023	16:00	399,67	3,29	3,02	37,45	37,22	94,87	86,55
15/12/2023	17:00	180,6	0,72	0,66	35,72	35,51	19,80	18,05

Hasil Pengujian Hari ke-5 (5 Kali Pembersihan)

Tanggal	Jam	Radiasi Matahari (W/m ²)	Arus PV1 (A)	Arus PV2 (A)	Tegangan PV1 (V)	Tegangan PV2 (V)	Daya PV1 (W)	Daya PV2 (W)
16/12/2023	08:00	440,59	3,52	2,65	37,73	37,17	102,26	75,85
16/12/2023	09:00	680,57	5,37	4,38	37,69	37,17	155,84	125,36
16/12/2023	10:00	796,57	6,88	5,71	37,66	37,23	199,51	163,69
16/12/2023	11:00	921,82	8,16	6,77	37,73	37,36	237,07	194,75
16/12/2023	12:00	974,9	9,06	8,34	37,46	37,14	261,33	238,51
16/12/2023	13:00	962,97	8,92	8,3	37,33	37,11	256,40	237,17
16/12/2023	14:00	856,58	7,64	6,78	37,44	37,26	220,25	194,52
16/12/2023	15:00	653,82	5,71	5,04	37,27	37,09	163,87	143,94
16/12/2023	16:00	489,21	3,82	3,32	37,57	37,35	110,51	95,48
16/12/2023	17:00	177,45	0,71	0,62	35,7	35,45	19,52	16,92

Efisiensi Panel Surya

Tanggal	Jam	Efisiensi PV1	Efisiensi PV2
12/12/2023	08:00	15,28%	13,32%

12/12/2023	09:00	12,80%	11,60%
12/12/2023	10:00	15,87%	15,12%
12/12/2023	11:00	15,93%	14,66%
12/12/2023	12:00	16,22%	15,13%
12/12/2023	13:00	16,07%	15,05%
12/12/2023	14:00	14,16%	12,87%
12/12/2023	15:00	14,48%	11,88%
12/12/2023	16:00	14,33%	13,38%
12/12/2023	17:00	7,30%	6,61%
Rata-rata		14,24%	12,96%
13/12/2023	08:00	14,20%	10,43%
13/12/2023	09:00	12,87%	9,48%
13/12/2023	10:00	14,36%	12,64%
13/12/2023	11:00	15,88%	14,30%
13/12/2023	12:00	15,56%	14,46%
13/12/2023	13:00	15,96%	14,52%
13/12/2023	14:00	15,68%	14,36%
13/12/2023	15:00	15,45%	13,73%
13/12/2023	16:00	13,93%	11,97%
13/12/2023	17:00	7,41%	6,69%
Rata-rata		14,13%	12,26%
14/12/2023	08:00	13,92%	10,38%
14/12/2023	09:00	13,17%	10,03%
14/12/2023	10:00	14,83%	13,02%
14/12/2023	11:00	15,79%	13,83%
14/12/2023	12:00	16,65%	14,14%
14/12/2023	13:00	15,94%	13,72%
14/12/2023	14:00	15,57%	12,87%
14/12/2023	15:00	13,84%	12,41%
14/12/2023	16:00	12,02%	10,45%
14/12/2023	17:00	7,18%	6,45%
Rata-rata		13,89%	11,73%
15/12/2023	08:00	14,18%	10,73%
15/12/2023	09:00	13,70%	11,27%
15/12/2023	10:00	14,88%	12,60%
15/12/2023	11:00	15,37%	13,55%
15/12/2023	12:00	13,90%	11,10%
15/12/2023	13:00	14,87%	13,82%
15/12/2023	14:00	15,93%	14,39%
15/12/2023	15:00	15,34%	13,34%
15/12/2023	16:00	14,48%	13,21%

15/12/2023	17:00	6,69%	6,10%
Rata-rata		13,93%	12,01%
16/12/2023	08:00	14,16%	10,50%
16/12/2023	09:00	13,97%	11,24%
16/12/2023	10:00	15,28%	12,54%
16/12/2023	11:00	15,69%	12,89%
16/12/2023	12:00	16,36%	14,93%
16/12/2023	13:00	16,25%	15,03%
16/12/2023	14:00	15,69%	13,86%
16/12/2023	15:00	15,29%	13,43%
16/12/2023	16:00	13,78%	11,91%
16/12/2023	17:00	6,71%	5,82%
Rata-rata		14,32%	12,21%

Performa Rasio Panel Surya

Tanggal	Jam	Performa Rasio PV1 (%)	Performa Rasio PV2 (%)
12/12/2023	08:00	61,427	53,543
12/12/2023	09:00	51,437	46,631
12/12/2023	10:00	63,797	60,745
12/12/2023	11:00	64,005	58,922
12/12/2023	12:00	65,182	60,804
12/12/2023	13:00	64,570	60,490
12/12/2023	14:00	56,913	51,720
12/12/2023	15:00	58,185	47,747
12/12/2023	16:00	57,600	53,786
12/12/2023	17:00	29,348	26,572
Rata-rata		57,246	52,096
13/12/2023	08:00	57,085	41,920
13/12/2023	09:00	51,710	38,118
13/12/2023	10:00	57,694	50,778
13/12/2023	11:00	63,815	57,469
13/12/2023	12:00	62,547	58,110
13/12/2023	13:00	64,130	58,365
13/12/2023	14:00	63,024	57,706
13/12/2023	15:00	62,087	55,163
13/12/2023	16:00	55,999	48,123
13/12/2023	17:00	29,766	26,874
Rata-rata		56,786	49,263
14/12/2023	08:00	55,924	41,733
14/12/2023	09:00	52,934	40,307

14/12/2023	10:00	59,588	52,327
14/12/2023	11:00	63,438	55,564
14/12/2023	12:00	66,905	56,823
14/12/2023	13:00	64,050	55,131
14/12/2023	14:00	62,553	51,709
14/12/2023	15:00	55,635	49,878
14/12/2023	16:00	48,316	41,979
14/12/2023	17:00	28,849	25,910
Rata-rata		55,819	47,136
15/12/2023	08:00	56,968	43,109
15/12/2023	09:00	55,047	45,298
15/12/2023	10:00	59,810	50,618
15/12/2023	11:00	61,759	54,467
15/12/2023	12:00	55,879	44,606
15/12/2023	13:00	59,777	55,559
15/12/2023	14:00	64,016	57,826
15/12/2023	15:00	61,663	53,616
15/12/2023	16:00	58,208	53,102
15/12/2023	17:00	26,888	24,502
Rata-rata		56,001	48,270
16/12/2023	08:00	56,915	42,212
16/12/2023	09:00	56,151	45,168
16/12/2023	10:00	61,415	50,389
16/12/2023	11:00	63,061	51,806
16/12/2023	12:00	65,731	59,990
16/12/2023	13:00	65,289	60,393
16/12/2023	14:00	63,051	55,685
16/12/2023	15:00	61,457	53,984
16/12/2023	16:00	55,391	47,859
16/12/2023	17:00	26,970	23,386
Rata-rata		57,543	49,087

LAMPIRAN B PERHITUNGAN

A. Perhitungan Efisiensi Panel Surya

Nilai efisiensi panel suruya diperoleh melalui persamaan (2.5), sebagai contoh sempel perhitungan pada pukul 12:00 tanggal 12 Desember 2023 yaitu sebagai berikut:

1. PV Kotor

$$A \text{ PV Kotor} : 1,6389 \text{ m}^2$$

$$I_r \text{ PV Kotor} : 923,55 \text{ W/m}^2$$

$$P_{out} \text{ PV kotor} : 229,01 \text{ W}$$

Maka:

$$P_{in} = I_r \times A$$

$$P_{in} = 923,55 \times 1,6389$$

$$P_{in} = 1513,60$$

$$\eta_p = \frac{P_{out}}{P_{in}} \times 100\%$$

$$\eta_p = \frac{229,01}{1513,60} \times 100\%$$

$$\eta_p = 15,13\%$$

2. PV Bersih

$$A \text{ PV Bersih} : 1,6389 \text{ m}^2$$

$$I_r \text{ PV Bersih} : 923,55 \text{ W/m}^2$$

$$P_{out} \text{ PV Bersih} : 245,50 \text{ W}$$

Maka:

$$P_{in} = I_r \times A$$

$$P_{in} = 923,55 \times 1,6389$$

$$P_{in} = 1513,60$$

$$\eta_p = \frac{P_{out}}{P_{in}} \times 100\%$$

$$\eta_p = \frac{245,50}{1513,60} \times 100\%$$

$$\eta_p = 16,22\%$$

B. Perhitungan Performa Rasio

Nilai performa rasio diperoleh dari persamaan (2.6), berikut contoh perhitungan performa rasio:

1. PV Kotor

$$I_r \text{ PV Kotor} : 923,55 \text{ W/m}^2$$

$$P_{out} \text{ PV kotor} : 229,01 \text{ W}$$

$$P_{max} \text{ PV kotor} : 407,81 \text{ W}$$

Maka:

$$PR = \left(\frac{P_{out}}{P_{max}} \right) / \left(\frac{I_r}{1000} \right)$$

$$PR = \left(\frac{229,01}{407,81} \right) / \left(\frac{923,55}{1000} \right)$$

$$PR = \frac{0,561}{0,923} \times 100\%$$

$$PR = 60,80\%$$

2. PV Bersih

$$I_r \text{ PV Kotor} : 923,55 \text{ W/m}^2$$

$$P_{out} \text{ PV kotor} : 245,50 \text{ W}$$

$$P_{max} \text{ PV kotor} : 407,81 \text{ W}$$

Maka:

$$PR = \left(\frac{P_{out}}{P_{max}} \right) / \left(\frac{I_r}{1000} \right)$$

$$PR = \left(\frac{245,50}{407,81} \right) / \left(\frac{923,55}{1000} \right)$$

$$PR = \frac{0,601}{0,923} \times 100\%$$

$$PR = 65,18\%$$

LAMPIRAN C LISTING PROGRAM

```
#include <analogWrite.h>

#define ENA 12
#define IN1 13
#define IN2 14

#define ENB 18
#define IN3 19
#define IN4 21

const int buttonPin = 2;

// State of the push button
int buttonState = 0;

void setup() {
  Serial.begin(9600);
  pinMode(buttonPin, INPUT_PULLUP);

  pinMode(ENA,OUTPUT);
  pinMode(IN1,OUTPUT);
  pinMode(IN2,OUTPUT);

  pinMode(ENB,OUTPUT);
  pinMode(IN3,OUTPUT);
  pinMode(IN4,OUTPUT);
}
void loop() {

  buttonState = digitalRead(buttonPin);
  Serial.println(buttonState);

  if (buttonState == HIGH) {
    analogWrite(ENA,125);
    digitalWrite(ENB,HIGH);
    digitalWrite(IN3,HIGH);
    digitalWrite(IN4,LOW);
    digitalWrite(IN1,HIGH);
    digitalWrite(IN2,LOW);
    delay(6900); // Pergi
    digitalWrite(IN1,LOW);
    digitalWrite(IN2,HIGH);
```

```
    delay(4000); // Pulang
  } else {
    digitalWrite(ENA,LOW);
    digitalWrite(ENB,LOW);
    digitalWrite(IN3,LOW);
    digitalWrite(IN4,LOW);
    digitalWrite(IN1,LOW);
    digitalWrite(IN2,LOW);
    delay(6300);
    digitalWrite(IN1,LOW);
    digitalWrite(IN2,LOW);
    delay(6300);
  }
}
```