

Halaman Lampiran

1. *Sketch* pemrograman arduino

```
#include <SPI.h>

#include <SD.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd (0x27 ,2,1,0,4,5,6,7,3, POSITIVE);

#include "I2Cdev.h"

#include "MPU6050_6Axis_MotionApps20.h"

#if I2CDEV_IMPLEMENTATION == I2CDEV_ARDUINO_WIRE

#include "Wire.h"

#endif

MPU6050 mpu;

const int chipSelect=4;

const int pin_ldr = A0;

const int pin_Vin = A1;

#include <Wire.h>

#include <virtuabotixRTC.h>

virtuabotixRTC myRTC(6,7,8);

bool blinkState = false;

bool dmpReady = false;

uint8_t mpuIntStatus;
```

```
uint8_t devStatus;

uint16_t packetSize;

uint16_t fifoCount;

uint8_t fifoBuffer[64];

Quaternion q;

VectorInt16 aa;

VectorInt16 aaReal;

VectorInt16 aaWorld;

VectorFloat gravity;

float euler[3];

float ypr[3];

float a,b,c, sudut;

float a1,b1,c1;

boolean pushbutton;

uint8_t teapotPacket[14] = { '$', 0x02, 0, 0, 0, 0, 0, 0, 0, 0, 0x00, 0x00, '\r', '\n' };

volatile bool mpuInterrupt = false;

void dmpDataReady()

{

    mpuInterrupt = true;

}

void setup()
```

```
{  
  
  Serial.begin(9600);  
  
  //myRTC.setDS1302Time(00,48,10,6,13,8,2018);  
  
  lcd.begin(16, 2);  
  
  while(!Serial){}  
  
  Serial.print("proses indentifikasi SD card...");  
  
  pinMode(10,OUTPUT);  
  
  if (!SD.begin(chipSelect))  
  {  
    Serial.println("SD card tidak terbaca");  
  
    return;  
  }  
  
  Serial.println("SD card ditemukan");  
  
  #if I2CDEV_IMPLEMENTATION == I2CDEV_ARDUINO_WIRE  
  
  Wire.begin();  
  
  TWBR = 24;  
  
  #elif I2CDEV_IMPLEMENTATION == I2CDEV_BUILTIN_FASTWIRE  
  
  Fastwire::setup(400, true);  
  
  #endif  
  
  Serial.begin(9600);  
  
  mpu.initialize();
```

```
Serial.println(mpu.testConnection() ? F("MPU6050 connection successful") :
F("MPU6050 connection failed"));

devStatus = mpu.dmpInitialize();

mpu.setXGyroOffset(32);

mpu.setYGyroOffset(-17);

mpu.setZGyroOffset(0);

mpu.setXAccelOffset(-589);

mpu.setYAccelOffset(467);

mpu.setZAccelOffset(604);

if (devStatus == 0)
{
    mpu.setDMPEntered(true);

    attachInterrupt(0, dmpDataReady, RISING);

    mpuIntStatus = mpu.getIntStatus();

    dmpReady = true;

    packetSize = mpu.dmpGetFIFOpacketSize();
}
else
{
    Serial.print(F("DMP Initialization failed (code "));

    Serial.print(devStatus);
```

```
        Serial.println(F(""));
    }
}

void loop()
{
    if (!dmpReady) return;

    while (!mpuInterrupt && fifoCount < packetSize)
    {
        mpuInterrupt = false;

        mpuIntStatus = mpu.getIntStatus();

        fifoCount = mpu.getFIFOCount();

        if ((mpuIntStatus & 0x10) || fifoCount == 1024)
        {
            mpu.resetFIFO();

            Serial.println(F("-----FIFO overflow!-----"));
        }

        else if (mpuIntStatus & 0x02)
        {
            while (fifoCount < packetSize) fifoCount = mpu.getFIFOCount();

            mpu.getFIFOBytes(fifoBuffer, packetSize);

            fifoCount -= packetSize;
        }
    }
}
```

```
mpu.dmpGetQuaternion(&q, fifoBuffer);

mpu.dmpGetGravity(&gravity, &q);

mpu.dmpGetYawPitchRoll(ypr, &q, &gravity);

{

    sudut = ypr[0] * 180 / M_PI;

    lcd.setCursor(0,0);

    lcd.print(sudut);

    lcd.print(" ' ");

    delay(1000);

}

a1 = ypr[0] * 180 / M_PI;

b1 = ypr[1] * 180 / M_PI;

c1 = ypr[2] * 180 / M_PI;

if(pushbutton == LOW)

{

    a = a1;

    b = b1;

    c = c1;

}

check(b,b1,0.7);

}
```

```
int nilai_Vin = analogRead (pin_Vin);

float tegangan_hasil2 = (5.0 * nilai_Vin/ 1023) * 7.803;

lcd.setCursor(9,0);

lcd.print(tegangan_hasil2);

lcd.print("v");

int nilai_ldr = analogRead (pin_ldr);

float tegangan_hasil = nilai_ldr * 3.6458 + 3.7936;

lcd.setCursor(0,1);

lcd.print(tegangan_hasil);

lcd.print("Lux");

delay(100);

File dataFile=SD.open("coba6.txt",FILE_WRITE);

if(dataFile)

{

myRTC.updateTime();

lcd.setCursor (11,1);

lcd.print("Current Date / Time: ");

lcd.print(myRTC.dayofmonth);

lcd.print("/");

lcd.print(myRTC.month);

lcd.print("/");
```

```
lcd.print(myRTC.year);

lcd.print(" ");

lcd.print(myRTC.hours);

lcd.print(":");

lcd.print(myRTC.minutes);

lcd.print(":");

lcd.println(myRTC.seconds);

delay( 1000);

}

dataFile.print("sudut=");

dataFile.print(sudut);

dataFile.print(" ");

dataFile.print("vin=");

dataFile.print(tegangan_hasil2);

dataFile.print(" ");

dataFile.print("Lux=");

dataFile.print(tegangan_hasil);

dataFile.print(" ");

dataFile.print("Date / Time: ");

dataFile.print(myRTC.dayofmonth);

dataFile.print("/");
```



```
dataFile.print(myRTC.month);

dataFile.print("/");

dataFile.print(myRTC.year);

dataFile.print(" ");

dataFile.print(myRTC.hours);

dataFile.print(":");

dataFile.println(myRTC.minutes);

dataFile.close();

}

void check(float data, float current,float range)

{

float Min=data-range;

float Max=data+range;

}
```

2. Tabel hasil akhir penelitian data logger dengan memodifikasi pengambilan data dengan rentang waktu 5 menit.

NO	Waktu	Sudut °	Intensitas cahaya (Lux)	Tegangan (V)
1	5:30	114.48	426.71	6.1
2	5:35	114.48	437.64	6.22
3	5:40	114.48	441.29	6.29
4	5:45	114.48	444.94	6.37
5	5:50	114.48	448.58	6.79
6	5:55	114.48	598.06	8.96
7	6:00	114.48	743.89	10.3
8	6:05	114.48	886.08	12.32
9	6:10	114.48	1013.68	15.41
10	6:15	114.48	1119.41	16.25
11	6:20	114.48	1217.84	16.9
12	6:25	114.48	1301.7	17.35
13	6:30	114.48	1374.61	17.77
14	6:35	114.48	1443.88	18.08
15	6:40	114.48	1502.22	18.34
16	6:45	114.48	1553.26	18.5
17	6:50	114.48	1604.3	18.69
18	6:55	114.48	1651.7	18.84
19	7:00	114.48	1680.86	18.92
20	7:05	114.48	1724.61	19.07
21	7:10	114.48	1761.07	19.15
22	7:15	114.48	1782.94	19.18
23	7:20	114.48	1815.76	19.26
24	7:25	114.48	1837.63	19.3
25	7:30	114.48	1870.44	19.37
26	7:35	114.48	1885.03	19.41
27	7:40	114.48	1917.84	19.49
28	7:45	114.48	1950.65	19.56
29	7:50	114.48	1968.88	19.6
30	7:55	114.48	1987.11	19.62
31	8:00	114.48	1998.05	19.64
32	8:05	114.48	2016.28	19.66
33	8:10	114.48	2038.15	19.68
34	8:15	114.48	2052.73	19.68

Lanjutan tabel hasil pengujian akhir

NO	Waktu	Sudut °	Intensitas cahaya (Lux)	Tegangan (V)
35	8:20	114.48	2092.84	19.7
36	8:25	114.48	2103.77	19.72
37	8:30	114.48	2114.71	19.74
38	8:35	114.48	2118.36	19.75
39	8:40	114.48	2147.52	19.76
40	8:45	114.48	2154.82	20.17
41	8:50	114.48	2173.04	20.21
42	8:55	114.48	2475.65	20.33
43	9:00	114.48	2482.94	20.36
44	9:05	114.48	2526.69	20.38
45	9:10	114.48	2548.56	20.41
46	9:15	114.48	2570.44	20.46
47	9:20	114.48	2577.73	20.59
48	9:25	114.48	2577.73	20.62
49	9:30	114.48	2603.25	20.67
50	9:35	114.48	2609.28	20.68
51	9:40	114.48	2610.46	20.7
52	9:45	114.48	2611.76	20.71
53	9:50	114.48	2612.02	20.72
54	9:55	114.48	2612.28	20.74
55	10:00	114.48	2612.88	20.75
56	10:05	114.48	2613.55	20.77
57	10:10	114.48	2613.78	20.79
58	10:15	114.48	2614.12	20.8
59	10:20	114.48	2615.98	20.82
60	10:25	114.48	2616.11	20.83
61	10:30	114.48	2616.57	20.85
62	10:35	114.48	2617.89	20.88
63	10:40	114.48	2618.34	20.92
64	10:45	114.48	2619.22	20.98
65	10:50	114.48	2622.19	21.23
66	10:55	114.48	2626.25	21.45
67	11:00	114.48	2628.77	21.55
68	11:05	114.48	2654.29	21.58

Lanjutan tabel hasil pengujian akhir

NO	Waktu	Sudut °	Intensitas cahaya (Lux)	Tegangan (V)
69	11:10	114.48	2676.17	21.58
70	11:15	114.48	2676.17	21.58
71	11:20	114.48	2679.81	21.58
72	11:25	114.48	2683.46	21.58
73	11:30	114.48	2668.87	21.58
74	11:35	114.48	2690.75	20.44
75	11:40	114.48	2687.1	20.48
76	11:45	114.48	2687.1	20.48
77	11:50	114.48	2694.39	20.56
78	11:55	114.48	2687.1	20.59
79	12:00	114.48	2683.46	20.63
80	12:05	114.48	2679.81	20.59
81	12:10	114.48	2679.81	20.56
82	12:15	114.48	2676.17	20.52
83	12:20	114.48	2672.52	20.52
84	12:25	114.48	2672.52	20.52
85	12:30	114.48	2668.87	20.4
86	12:35	114.48	2661.58	20.33
87	12:40	114.48	2665.23	20.06
88	12:45	114.48	2661.58	19.64
89	12:50	114.48	2647	19.37
90	12:55	114.48	2643.35	19.26
91	13:00	114.48	2639.71	19.15
92	13:05	114.48	2628.77	18.92
93	13:10	114.48	2136.59	18.76
94	13:15	114.48	2129.3	18.88
95	13:20	114.48	2125.65	18.92
96	13:25	114.48	2122	18.92
97	13:30	114.48	2111.07	18.95
98	13:35	114.48	2101.62	18.95
99	13:40	114.48	2092.17	18.95
100	13:45	114.48	2082.74	18.95
101	13:50	114.48	2073.28	18.95
102	13:55	114.48	2063.84	18.95
103	14:00	114.48	2054.38	18.95

Lanjutan tabel hasil pengujian akhir

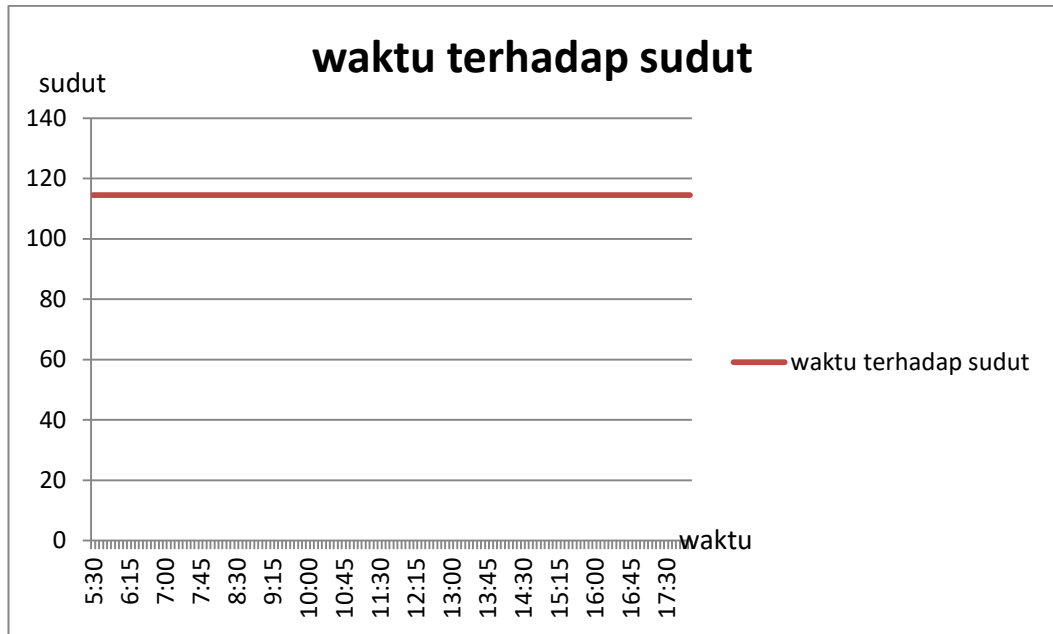
NO	Waktu	Sudut °	Intensitas cahaya (Lux)	Tegangan (V)
104	14:05	114.48	2044.33	18.95
105	14:10	114.48	2034.88	18.95
106	14:15	114.48	2026.05	18.95
107	14:20	114.48	2016.58	18.95
108	14:25	114.48	2007.13	18.95
109	14:30	114.48	1997.77	18.95
110	14:35	114.48	1988.24	18.95
111	14:40	114.48	1988.2	18.95
112	14:45	114.48	1968.86	18.88
113	14:50	114.48	1959.88	18.74
114	14:55	114.48	1950.46	18.68
115	15:00	114.48	1940.9	18.65
116	15:05	114.48	1932.88	18.63
117	15:10	114.48	1924.05	18.57
118	15:15	114.48	1912.8	18.55
119	15:20	114.48	1904.89	18.54
120	15:25	114.48	1889.75	18.52
121	15:30	114.48	1884.77	18.49
122	15:35	114.48	1876.82	18.47
123	15:40	114.48	1864.76	18.42
124	15:45	114.48	1855.67	18.39
125	15:50	114.48	1848.88	18.36
126	15:55	114.48	1843.67	18.33
127	16:00	114.48	1837.63	18.32
128	16:05	114.48	1837.54	18.3
129	16:10	114.48	1837.3	18.28
130	16:15	114.48	1841.28	18.23
131	16:20	114.48	1830.34	18.19
132	16:25	114.48	1812.11	18.12
133	16:30	114.48	1801.17	18.08
134	16:35	114.48	1782.94	18.02
135	16:40	114.48	1761.07	17.89
136	16:45	114.48	1739.19	17.77
137	16:50	114.48	1710.03	17.73

Lanjutan tabel hasil pengujian akhir

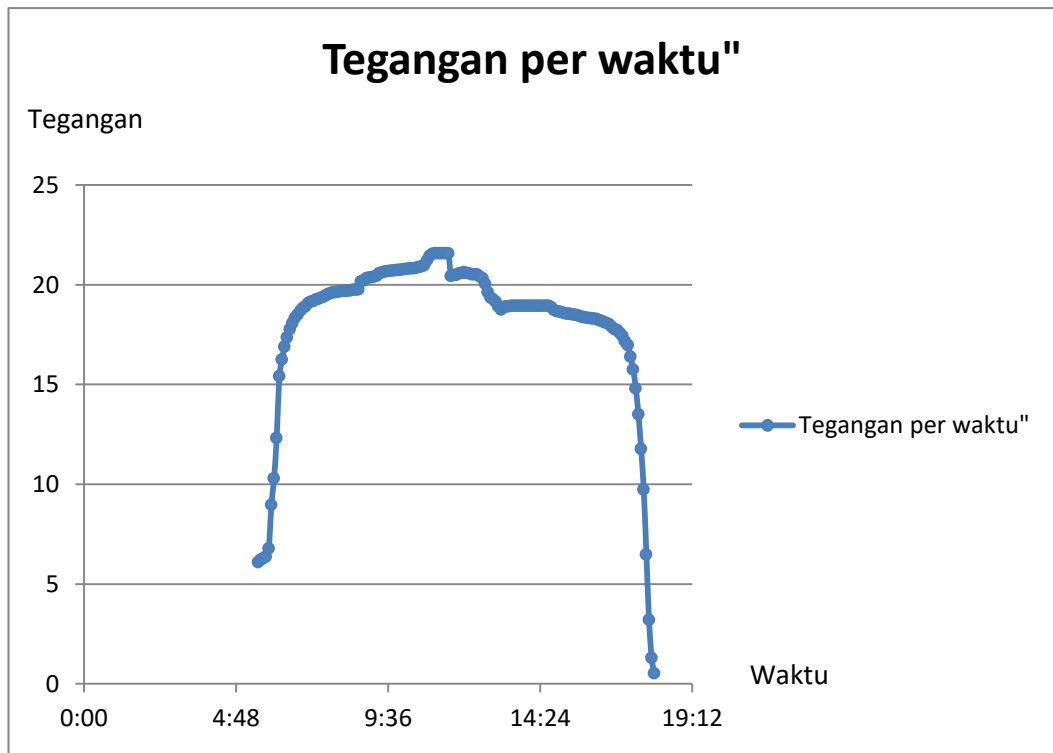
NO	Waktu	Sudut °	Intensitas cahaya (Lux)	Tegangan (V)
138	16:55	114.48	1677.22	17.58
139	17:00	114.48	1637.11	17.43
140	17:05	114.48	1597.01	17.16
141	17:10	114.48	1535.03	16.97
142	17:15	114.48	1465.76	16.4
143	17:20	114.48	1378.26	15.75
144	17:25	114.48	1276.18	14.8
145	17:30	114.48	1159.51	13.5
146	17:35	114.48	1013.68	11.78
147	17:40	114.48	845.97	9.73
148	17:45	114.48	630.87	6.48
149	17:50	114.48	412.12	3.2
150	17:55	114.48	251.71	1.3
151	18:00	114.48	171.5	0.53

3. Data Logger dalam format grafik

a. Hubungan antara waktu terhadap sudut



b. Hubungan antara waktu terhadap tegangan



c. Hubungan antara waktu terhadap intensitas cahaya

