Halaman Lampiran

1. Sketch pemrograman arduino

```cpp
#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_ADUINO_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, 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.setDMPEnabled(true);
    attachInterrupt(0, dmpDataReady, RISING);
    mpuIntStatus = mpu.getIntStatus();
    dmpReady = true;
    packetSize = mpu.dmpGetFIFOPacketSize();
}
else
{
    Serial.print(F("DMP Initialization failed (code "));
    Serial.print(devStatus);
}
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(" ' ");
    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.

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3. Data Logger dalam format grafik

a. Hubungan antara waktu terhadap sudut

![Diagram: Hubungan waktu terhadap sudut]

b. Hubungan antara waktu terhadap tegangan

![Diagram: Hubungan waktu terhadap tegangan]
c. Hubungan antara waktu terhadap intensitas cahaya

![Diagram Waktu terhadap Intensitas cahaya](image-url)