

LAMPIRAN 1.

Perancangan dan Implementasi Kontrol PID Pada Robot Penyapu Lantai


by Rachdian Muhammad Adha

Pembimbing 1



Bustanul Arifin

Pembimbing 2



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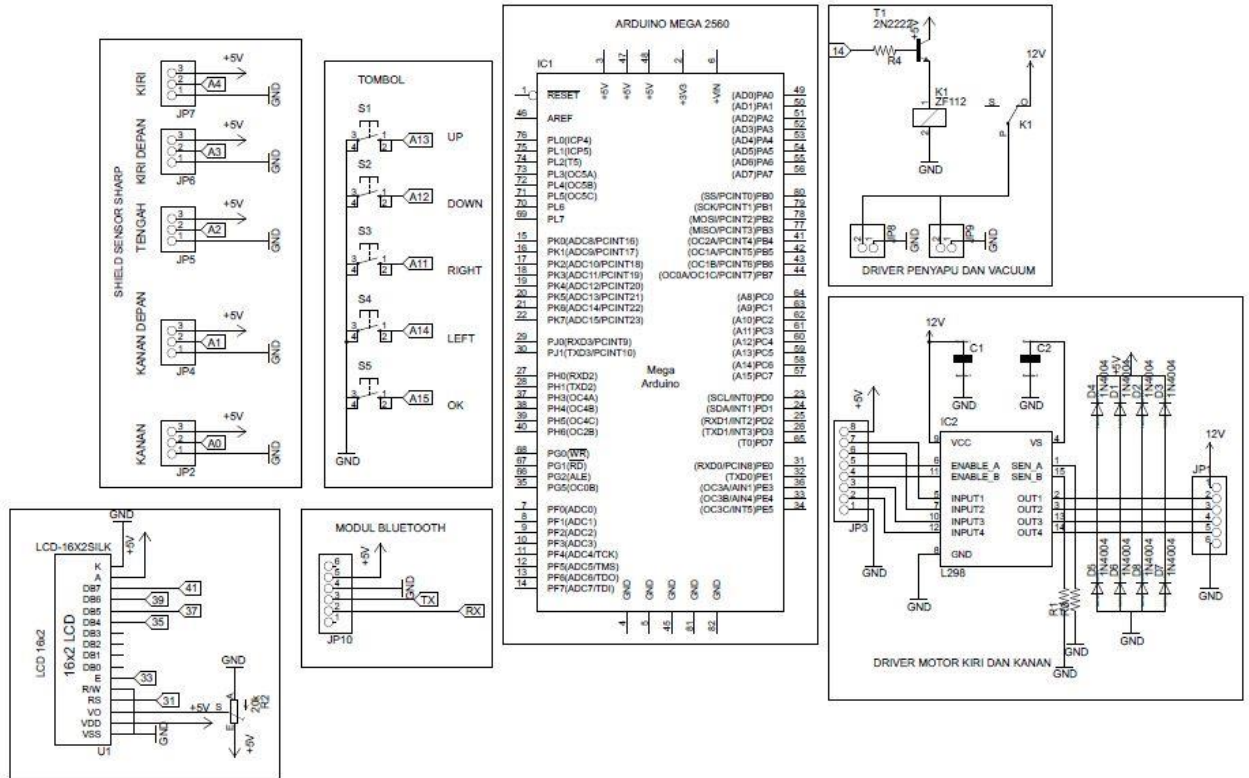
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LAMPIRAN 2.

SKEMATIK RANGKAIAN ROBOT KESELURUHAN







LAMPIRAN 3.

Pembimbing I : Bustanul Arifin ST.,MT.

KEGIATAN ASISTENSI PERIODE II

(2 bulan)

Tanggal: _____ s/d tanggal: _____





No	Hari/Tanggal	Paraf Dosen	Catatan
1	Senin 02 Juli 2018		<ul style="list-style-type: none"> - Lengkapi dg daftar pustaka utk setiap acuan pustaka yg digunakan - Lanjutkan ke perancangan software
2	Kamis 2 Agustus '18		<ul style="list-style-type: none"> - Dimensi robot disampaikan di bab 3 - Software dibuat lebih rapat spasinya - Flowchart diperbaiki
			<ul style="list-style-type: none"> - Lanjut ke bab 4
3	Kamis 6 September 18		<ul style="list-style-type: none"> - Untuk bab 3 pemrograman Sharp gp untuk mendapatkan jarak belum ada - Tabel di bab 4 tentang PID tidak boleh ada cetak tebal (cetak tebal hanya untuk judul saja) - lengkapi bab 4
4	Senin 17 September 18		<ul style="list-style-type: none"> - Silahkan dilanjutkan ke Bab 5 - lengkapi lembar penunjang seperti cover, abstrak, lampiran, daftar isi, dll. - Buat makalah tugas akhir

Pembimbing II : Eka Nuryanto Budisusila, ST.,MT.

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	5/6 18		<ul style="list-style-type: none"> Bab I, II, III Revisi - Lembar kerja - Lembar program - Melengkapi pengisian
	2/8 1/8		<ul style="list-style-type: none"> Bab. III - uraian balok dan seri Holo dengan - Serupa Flowchart
	6/9 18		<ul style="list-style-type: none"> Bab. III - Secara umum sudah baik - notifikasi gambar bila beda halaman bisa di bedikan
			<ul style="list-style-type: none"> - Lanjutkan pemrograman
	5/9 18		<ul style="list-style-type: none"> - Tittle pengujian - Sensor, prosesor (programming) Aktuator (Motor) - Regulator x sensor → Kontrol x Sistem pengendalian



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Penguji, II

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LAMPIRAN 4.

PROGRAM ROBOT KESELURUHAN

```
#include <LiquidCrystal.h>
#include <EEPROM.h>

//Setting LCD      RS  E   D4  D5  D6  D7
LiquidCrystal lcd(31, 33, 35, 37, 39, 41);

//Inisialisasi Pin Sharp GP(2Y0A02Y)
#define adcJarKi A4//Sensor Kiri
#define adcJarKa A0//Sensor Kanan

//Inisialisasi Pin Sharp GP(2Y0A21)
#define adcJarKiD A3//Sensor Kiri Depan
#define adcJarKaD A1//Sensor Kanan Depan
#define adcJarD A2 //Sensor Tengah Depan

//Inisialisasi Pin Motor
#define motorKi1 32//Motor Kiri
#define motorKi2 34//Motor Kiri
#define motorKa1 36//Motor Kanan
#define motorKa2 38//Motor Kanan
#define pinPwmKi 9 //Pwm Kiri
#define pinPwmKa 10//Pwm Kanan

//Inisialisasi Pin Relay
#define pinRelay 45

//Inisialisasi Pin Tombol
#define swU A13//Tombol Atas
#define swD A11//Tombol Bawah
#define swL A14//Tombol Kiri
#define swR A12//Tombol Kanan
```

```

#define sw0 A15//Tombol OK

#define addSpeed 0
#define addKp 1
#define addKi 2
#define addKd 3
#define addSp 4

int error,lastError, iError, dError, pwmL, pwmR, count;
unsigned char Kp, Ki, Kd, Sp, SPEED;

const char *tampilMenu[12] = {
    "1.Mode :",
    "2.Speed : ",
    "3.Var Kp: ",
    "4.Var Ki: ",
    "5.Var Kd: ",
    "6.Var Sp: ",
    "7.Data ADC      ",
    "8.Data Jarak    ",
    "9.Nilai Gyro    ",
    "10.Tes PID: ",
    "11.Tes Zigzag   ",
    "12.Cek Hardware "
};

const char *tampilFollow[2] = {
    "Kiri ",
    "Kanan"
};

const char *tampilMode[6] = {
    "Zig-Zag  ",
    "Acak     ",
    "Ikut     "
};

```

```

    "Bluetooth",
    "Counter  "
};

void setup() {
    lcd.begin(16,2); //Pilih LCD 16x2
    // Serial3.begin(38400);
    Serial3.begin(9600);
    Serial.begin(9600);

    //Pin Motor Sebagai Output
    pinMode(motorKi1, OUTPUT);
    pinMode(motorKi2, OUTPUT);
    pinMode(motorKa1, OUTPUT);
    pinMode(motorKa2, OUTPUT);
    pinMode(motorKil1, OUTPUT);
    pinMode(pinPwmKi, OUTPUT);
    pinMode(pinPwmKa, OUTPUT);

    //Pin Relay Sebagai Output
    pinMode(pinRelay, OUTPUT);
    vacuumOFF();

    //Pin Tombol
    pinMode(swO, INPUT_PULLUP);
    pinMode(swU, INPUT_PULLUP);
    pinMode(swD, INPUT_PULLUP);
    pinMode(swL, INPUT_PULLUP);
    pinMode(swR, INPUT_PULLUP);

    SPEED = EEPROM.read(addSpeed);
    Kp = EEPROM.read(addKp);
    Ki = EEPROM.read(addKi);
    Kd = EEPROM.read(addKd);
    Sp = EEPROM.read(addSp);

```

```
}
```

```
void loop(){
```

```
    menu();
```

```
}
```

```
void menu(){
```

```
    int m=0, follow, mode;
```

```
    while(1){
```

```
        lcd.setCursor(0,0); lcd.print("  SWEEP ROBOT  ");
```

```
        lcd.setCursor(0,1); lcd.print(tampilMenu[m]);
```

```
        if(m==0){lcd.print(tampilMode[mode]);}
```

```
        else if(m==1){lcd.print(SPEED); lcd.print("  ");}
```

```
        else if(m==2){lcd.print(Kp); lcd.print("  ");}
```

```
        else if(m==3){lcd.print(Ki); lcd.print("  ");}
```

```
        else if(m==4){lcd.print(Kd); lcd.print("  ");}
```

```
        else if(m==5){lcd.print(Sp); lcd.print("  ");}
```

```
        else if(m==9){lcd.print(tampilFollow[follow]);}
```

```
        if(D()){m++; delay(200);}
```

```
        if(U()){m--; delay(200);}
```

```
        if(m>11){m=0;}
```

```
        if(m<0){m=11;}
```

```
        if(R() && m==0){mode++; delay(250);}
```

```
        if(L() && m==0){mode--; delay(250);}
```

```
        if(R() && m==1){SPEED++; delay(100); EEPROM.write(addSpeed, SPEED);}
```

```
        if(L() && m==1){SPEED--; delay(100); EEPROM.write(addSpeed, SPEED);}
```

```
        if(R() && m==2){Kp++; delay(150); EEPROM.write(addKp, Kp);}
```

```
        if(L() && m==2){Kp--; delay(150); EEPROM.write(addKp, Kp);}
```

```
        if(R() && m==3){Ki++; delay(150); EEPROM.write(addKi, Ki);}
```

```
        if(L() && m==3){Ki--; delay(150); EEPROM.write(addKi, Ki);}
```

```
        if(R() && m==4){Kd++; delay(150); EEPROM.write(addKd, Kd);}
```

```
        if(L() && m==4){Kd--; delay(150); EEPROM.write(addKd, Kd);}
```

```
        if(R() && m==5){Sp++; delay(150); EEPROM.write(addSp, Sp);}
```



```

    if(L() && m==5){Sp--; delay(150); EEPROM.write(addSp,Sp);}
    if(R() && m==9){follow++; delay(250);}
    if(L() && m==9){follow--; delay(250);}

    if(follow>1){follow=0;}
    if(follow<0){follow=1;}
    if(mode>3){mode=0;}
    if(mode<0){mode=3;}

    if(O() && m==0 && mode==0){zigzag(); m=0;}
    if(O() && m==0 && mode==1){acak(); m=0;}
    if(O() && m==0 && mode==2){Ikut(); m=0;}
    if(O() && m==0 && mode==3){modeBluetooth(); m=0;}
    if(O() && m==6){tampilADC(); m=6;}
    else if(O() && m==7){tampilJarak(); m=7;}
    else if(O() && m==8){tampilGyro(); m=8;}
    else if(O() && m==9){cobaPID(follow); m=9;}
    else if(O() && m==10){zigzag(); m=10;}
    else if(O()){vacuumON();}
}
}

bool O() {
    if (digitalRead(swO) == 0) {
        return true;
    }
    else {
        return false;
    }
}

bool D() {
    if (digitalRead(swD) == 0) {
        return true;
    }
    else {

```

```
        return false;
    }
}
bool U() {
    if (digitalRead(swU) == 0) {
        return true;
    }
    else {
        return false;
    }
}
bool R() {
    if (digitalRead(swR) == 0) {
        return true;
    }
    else {
        return false;
    }
}
bool L() {
    if (digitalRead(swL) == 0) {
        return true;
    }
    else {
        return false;
    }
}
void vacuumON(){
    digitalWrite(pinRelay,LOW);
}
void vacuumOFF(){
    digitalWrite(pinRelay,HIGH);
}

unsigned int jarKiD(){
```

```

unsigned int adc, jarak;
adc = analogRead(adcJarKiD);
jarak = 4800 / (adc - 2);
if (jarak > 99) {
    jarak = 99;
}
if (jarak < 1) {
    jarak = 99;
}
return jarak;
}

unsigned int jarDe(){
    unsigned int adc, jarak;
    adc = analogRead(adcJarD);
    jarak = 4800 / (adc - 2);
    if (jarak > 99) {
        jarak = 99;
    }
    if (jarak < 1) {
        jarak = 99;
    }
    return jarak;
}

unsigned int jarKaD(){
    unsigned int adc, jarak;
    adc = analogRead(adcJarKaD);
    jarak = 4800 / (adc - 2);
    if (jarak > 99) {
        jarak = 99;
    }
    if (jarak < 1) {
        jarak = 99;
    }
    return jarak;
}

```

```

unsigned int jarKa(){
    unsigned int adc,jarak;
    adc = analogRead(adcJarKa);
    jarak=9462/(adc-16.92);
    if(jarak>200 || jarak<1){jarak=200;}
    return jarak;
}

unsigned int jarKi(){
    unsigned int adc,jarak;
    adc = analogRead(adcJarKi);
    jarak=9462/(adc-16.92);
    if(jarak>200 || jarak<1){jarak=200;}
    return jarak;
}

void motor(int L, int R){
    if(L>0){
        digitalWrite(motorKi1,HIGH);
        digitalWrite(motorKi2,LOW);
        analogWrite(pinPwmKi,L);
    } else if(L<0){
        digitalWrite(motorKi1,LOW);
        digitalWrite(motorKi2,HIGH);
        analogWrite(pinPwmKi,-L);
    } else {
        digitalWrite(pinPwmKi,LOW);
    }

    if(R>0){
        digitalWrite(motorKa1,HIGH);
        digitalWrite(motorKa2,LOW);
        analogWrite(pinPwmKa,R);
    } else if(R<0){
        digitalWrite(motorKa1,LOW);
        digitalWrite(motorKa2,HIGH);
    }
}

```

```

        analogWrite (pinPwmKa, -R);
    } else {
        digitalWrite (pinPwmKa, LOW);
    }
}

void pidMajuL(int sp){
// float kp=10, ki=0, kd=20, P,I,D,PID, Speed = 150;
float kp=Kp, ki=Ki, kd=Kd, P,I,D,PID, Speed = SPEED;

error = jarKiD() - sp;

iError = iError + error;
dError = lastError - error;

P = error * kp;
I = iError * ki;
D = dError * kd;

PID = P + I + D;

pwmL = Speed + PID;
pwmR = Speed - PID;

if (pwmL<50) {pwmL=50;}
if (pwmR<50) {pwmR=50;}
if (pwmL>255) {pwmL=255;}
if (pwmR>255) {pwmR=255;}

if (jarKiD()<5) {pwmL=255; pwmR=-100;}
if (jarDe()<5) {pwmL=255; pwmR=-255;}

motor (pwmL, pwmR);
}

```

```

void pidMajuR(int sp){
// float kp=10, ki=0, kd=20, P,I,D,PID, Speed = 150;
float kp=Kp, ki=Ki, kd=Kd, P,I,D,PID, Speed = SPEED;

error = jarKaD() - sp;

iError = iError + error;
dError = lastError - error;

P = error * kp;
I = iError * ki;
D = dError * kd;

PID = P + I + D;

pwmR = Speed + PID;
pwmL = Speed - PID;

if (pwmL<50) {pwmL=50;}
if (pwmR<50) {pwmR=50;}
if (pwmL>255) {pwmL=255;}
if (pwmR>255) {pwmR=255;}

if (jarKaD()<5) {pwmR=255; pwmL=-100;}
if (jarDe()<5) {pwmL=-255; pwmR=255;}

motor(pwmL, pwmR);
}

void pidMajuL1(int sp){
// float kp=10, ki=0, kd=20, P,I,D,PID, Speed = 150;
float kp=Kp, ki=Ki, kd=Kd, P,I,D,PID, Speed = SPEED;

error = jarKi() - sp;

```

```

iError = iError + error;
dError = lastError - error;

P = error * kp;
I = iError * ki;
D = dError * kd;

PID = P + I + D;

pwmL = Speed + PID;
pwmR = Speed - PID;

if (pwmL < 50) {pwmL=50;}
if (pwmR < 50) {pwmR=50;}
if (pwmL > 255) {pwmL=255;}
if (pwmR > 255) {pwmR=255;}

if (jarKiD() < 5) {pwmL=255; pwmR=-100;}
if (jarDe() < 5) {pwmL=255; pwmR=-255;}

motor(pwmL, pwmR);
}

void pidMajuR1(int sp){
// float kp=10, ki=0, kd=20, P,I,D,PID, Speed = 150;
float kp=Kp, ki=Ki, kd=Kd, P,I,D,PID, Speed = SPEED;

error = jarKa() - sp;

iError = iError + error;
dError = lastError - error;

P = error * kp;
I = iError * ki;

```

```

D = dError * kd;

PID = P + I + D;

pwmR = Speed + PID;
pwmL = Speed - PID;

if (pwmL < 50) {pwmL = 50;}
if (pwmR < 50) {pwmR = 50;}
if (pwmL > 255) {pwmL = 255;}
if (pwmR > 255) {pwmR = 255;}

if (jarKaD() < 5) {pwmR = 255; pwmL = -100;}
if (jarDe() < 5) {pwmL = -255; pwmR = 255;}

motor(pwmL, pwmR);
}

String inString = "";
float dataGyro, Theta;
float parseGyro() {
    int dataG;
    while (Serial3.available() > 0) {
        int inChar = Serial3.read();

        if (inChar != '\n') {
            inString += (char)inChar;
        }
        else {
            dataGyro = inString.toFloat();
            inString = "";
        }
    }
}

if (dataGyro < 0) {

```



```

    Theta = 360 + dataGyro;
} else {
    Theta = dataGyro;
}
if (Theta > 180) {
    Theta = Theta - 360;
}

return Theta;
}

```

```

void tampilGyro(){
    delay(500); lcd.clear();
    while(1){
        lcd.setCursor(0,0);
        lcd.print("Data Gyro ");
        lcd.setCursor(4,1);
        lcd.print(parseGyro()); lcd.print(" ");

        if (U()) { Serial3.println("0#");}

        if(O()){delay(200); break;}
    }
    delay(500); lcd.clear();
}

```

```

void tampilADC(){
    int pilih=1;
    delay(500); lcd.clear();
    while(1){
        lcd.setCursor(0,0);
        lcd.print("data ADC:"); lcd.print(pilih); lcd.print(" ");

        if(R()){pilih++; delay(200); }
        if(L()){pilih--; delay(200); }
    }
}

```

```

    if(pilih>5){pilih=1;}
    if(pilih<1){pilih=5;}

    lcd.setCursor(5,1);
    if(pilih==1){lcd.print(analogRead(adcJarKi)); lcd.print(" ");
    delay(100);}
    if(pilih==2){lcd.print(analogRead(adcJarKiD)); lcd.print(" ");
    delay(100);}
    if(pilih==3){lcd.print(analogRead(adcJarD)); lcd.print(" ");
    delay(100);}
    if(pilih==4){lcd.print(analogRead(adcJarKaD)); lcd.print(" ");
    delay(100);}
    if(pilih==5){lcd.print(analogRead(adcJarKa)); lcd.print(" ");
    delay(100);}

    if(O()){delay(200); break;}
}

delay(500); lcd.clear();
}

void tampilJarak(){
    int pilih=1;
    delay(500); lcd.clear();
    while(1){
        lcd.setCursor(0,0);
        lcd.print("data Jarak:"); lcd.print(pilih); lcd.print(" ");

        if(R()){pilih++; delay(200); }
        if(L()){pilih--; delay(200); }

        if(pilih>5){pilih=1;}
        if(pilih<1){pilih=5;}

        lcd.setCursor(5,1);
        if(pilih==1){lcd.print(jarKi()); lcd.print(" cm "); delay(100);}

```

```

    if(pilih==2){lcd.print(jarKiD()); lcd.print(" cm "); delay(100);}
    if(pilih==3){lcd.print(jarDe()); lcd.print(" cm "); delay(100);}
    if(pilih==4){lcd.print(jarKaD()); lcd.print(" cm "); delay(100);}
    if(pilih==5){lcd.print(jarKa()); lcd.print(" cm "); delay(100);}

    if(O()){delay(200); break;}
}

delay(500); lcd.clear();
}

void cobaPID(char foll){
    delay(500); lcd.clear();
    while(1){
        if(foll==0){
            pidMajuL(Sp);
        }
        else if(foll==1){
            pidMajuR(Sp);
        }
        else {return;}

        lcd.setCursor(0,0);
        lcd.print(jarKiD()); lcd.print(" ");
        lcd.print(jarDe()); lcd.print(" ");
        lcd.print(jarKaD()); lcd.print(" ");

        lcd.setCursor(0,1);
        lcd.print(jarKi()); lcd.print(" ");
        lcd.print(jarKa()); lcd.print(" ");
        lcd.print(pwmL); lcd.print(" ");
        lcd.print(pwmR); lcd.print(" ");

        if(O()){delay(200); break;}
    }
}

```

```

    }
    delay(500); lcd.clear();
}

//Mode Zig-Zag
void zigzag (){
    delay(500); lcd.clear();
    int setpoint=8;
    vacuumON();
    while(1){
        //follow kiri 1
        while(1){
            pidMajuL(10);
            if(jarDe()<10){
                motor(255,-255); delay(400);
                break;
            }
        }
        count=0; while(count<1400){count++; pidMajuL(12);} motor(255,-255);
        delay(400);

        //follow kanan 2
        while(1){
            pidMajuR(21);
            if(jarDe()<10){
                motor(-255,255); delay(400);
                break;
            }
        }
        count=0; while(count<1600){count++; pidMajuR(12);} motor(-255,255);
        delay(450);

        //follow kiri 3
        while(1){
            pidMajuL1(40);
            if(jarDe()<10){

```

```

        motor(255,-255); delay(450);
        break;
    }
}

count=0; while(count<1600){count++; pidMajuL(12);} motor(255,-255);
delay(500);

//follow kanan 4
while(1){
    pidMajuL1(40);
    if(jarDe()<10){
        motor(-255,255); delay(400);
        break;
    }
}

count=0; while(count<1700){count++; pidMajuR(12);} motor(-255,255);
delay(480);

//follow kanan 5
while(1){
    pidMajuR(22);
    if(jarDe()<10){
        motor(255,-255); delay(400);
        break;
    }
}

//follow kiri 6
while(1){
    pidMajuL(10);
    if(jarDe()<10){
        motor(255,-255); delay(500);
        break;
    }
}
}

```

```

//follow kiri 7
while(1){
    pidMajuL(10);
    if(jarDe()<10){
        motor(255,-255); delay(400);
        break;
    }
}

//follow kiri 8
while(1){
    pidMajuL(10);
    if(jarDe()<8){
        motor(255, 255); delay(70);
        motor(255,-255); delay(580);
        break;
    }
}
motor(-255,-255); delay(200);
vacuumOFF();
motor(0,0);
break;
}
delay(500); lcd.clear();
}

// Mode Acak
void acak (){
    delay(500); lcd.clear();
    vacuumON();
    while(1){
        motor(255,255);
        if(jarDe()<8){
            motor(255,-255); delay(400);
        }
    }
}

```

```

    if(jarKiD()<8){
        motor(255,-255); delay(200);
    }
    if(jarKaD()<8){
        motor(-255,255); delay(200);
    }

    if(R()){vacuumON();}
    if(L()){vacuumOFF();}
}

delay(500); lcd.clear();
}

//Mode Ikut Dinding
void Ikut (){
    delay(500); lcd.clear();
    vacuumON();
    while(1){
        //follow kiri 1
        while(1){
            pidMajuL(10);
            if(jarDe()<8){
                motor(255,-255); delay(500);
                break;
            }
        }
    }

    //follow kiri 1
    while(1){
        pidMajuL(10);
        if(jarDe()<8){
            motor(255,-255); delay(500);
            break;
        }
    }
}

```

```
}

//follow kiri 1
while(1){
    pidMajuL(10);
    if(jarDe() $<$ 8){
        motor(255,-255); delay(500);
        break;
    }
}

//follow kiri 1
while(1){
    pidMajuL(10);
    if(jarDe() $<$ 8){
        motor(255,-255); delay(500);
        break;
    }
}

//follow kiri 2
while(1){
    pidMajuL(20);
    if(jarDe() $<$ 10){
        motor(255,-255); delay(400);
        break;
    }
}

//follow kiri 2
while(1){
    pidMajuL(20);
    if(jarDe() $<$ 8){
        motor(255,-255); delay(400);
        break;
    }
}
```



```

}
//follow kiri 2
while(1){
  pidMajuL(20);
  if(jarDe()<8){
    motor(255,-255); delay(400);
    break;
  }
}
//follow kiri 2
while(1){
  pidMajuL(20);
  if(jarDe()<8){
    motor(255,-255); delay(400);
    break;
  }
}
motor(-255,-255); delay(400);
vacuumOFF();
motor(0,0);
break;
}
delay(500); lcd.clear();
}
//Mode Bluetooth
void modeBluetooth() {
  int der, drib, statusMaju = 0;
  while (0()) {} lcd.clear();
  while (!0()) {
    lcd.setCursor(0,0); lcd.print("Mode Bluetooth");

    int data = Serial3.read();
    lcd.setCursor(0, 1);

    if (data == 'F') {

```

```
    motor(255,255);
    lcd.print("Maju      ");
}
else if (data == 'B') {
    motor(-255,-255);
    lcd.print("Mundur    ");
}
else if (data == 'L') {
    motor(-180,180);
    lcd.print("Belok kiri  ");
}
else if (data == 'R') {
    motor(180,-180);
    lcd.print("Belok kanan ");
}
else if (data == 'G') {
    motor(-190,190);
    lcd.print("Putar kiri  ");
}
else if (data == 'I') {
    motor(190,-190);
    lcd.print("Putar kanan ");
}
else if (data == 'J') {
    motor(-190,190);
    lcd.print("Putar kiri  ");
}
else if (data == 'H') {
    motor(190,-190);
    lcd.print("Putar kanan");
}
else if (data == 'X') {
    vacuumON();
    lcd.print("Vacuum On  ");
}
}
```

```
else if (data == 'x') {
    vacuumOFF();
    lcd.print("Vacuum Off ");
}
else if (data == 'S') {
    motor(0, 0);
    lcd.print("stop      ");
}

}
lcd.clear(); motor(0, 0);
while (0()) {} delay(200);
}
```

LAMPIRAN 5.

GAMBAR ROBOT KESELURUHAN





