

LAMPIRAN



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LAMPIRAN 1

GAMBAR ALAT DAN DOKUMENTASI





Instalasi awal *Gas Engine* bersama Bapak Ir. Bambang Siswoyo, MT



Uji coba saat *running*



Gas Engine tampak depan



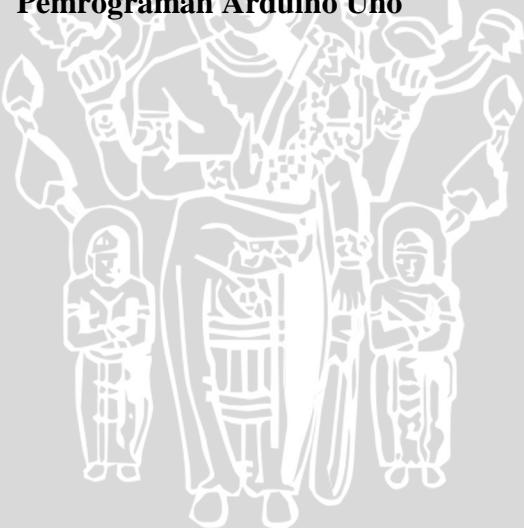
Gas Engine tampak samping



Pengujian *Gas Engine*



Pemrograman Arduino Uno



LAMPIRAN 2

LISTING PROGRAM



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//Ferditya Krisnanda; Elektro UB; PID for controling throttle of Gas Engine

```
#include <Servo.h>
```

```
Servo myservo; // objek servo yang dikontrol
```

```
double setPoint,error,dError,sError,lError,dTime,PID,errorTop,errorBot,kP,kI,kD;
```

```
unsigned long now,lTime;
```

```
int deg; // variabel servo
```

```
int ldeg; //derajat akhir
```

```
int konversi;//
```

```
int sensorpin = A1; //pin sensor = A1
```

```
int sensorvalue; // nilai sensor
```

```
float v_sen; // tegangan sensor
```

```
int rpm; // rpm putaran
```

```
int cnt=0;
```

```
void setup()
```

```
{
```

```
myservo.attach(9); // servo pada pin 9
```

```
Serial.begin(9600); // analog input
```

```
error = 0;
```

```
dError = 0;
```

```
sError = 0;
```

```
lError = 0;
```

```
dTime = 0;
```

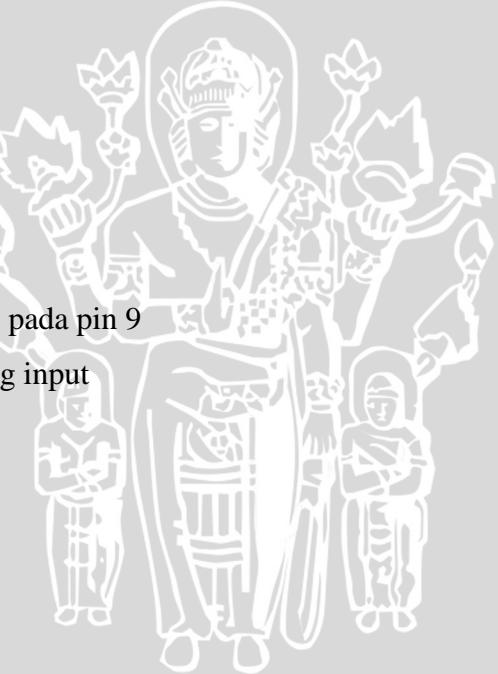
```
PID = 0;
```

```
/*parameter yang di set*/
```

```
setPoint = 6000;
```

```
ldeg=40+((setPoint-2453)/133); //40 adalah batas minimal mesin menyala, 133 adalah rata-rata kenaikan rpm/derajat
```

```
kP = 1;
```



```
kI = 0.01 ;  
kD = 0.12 ;  
}  
  
void loop()  
{  cnt=cnt+1;  
  /*konversi rpm*/  
  {  
    sensorvalue = analogRead(sensorpin); // perumusan nilai sensor  
    v_sen = sensorvalue *(5.0/1023.0); // tegangan sensor  
    rpm = 60*66*v_sen; // hasil rpm yang dihasilkan  
  }  
  
  /*perhitungan*/  
  {  
    now = millis();  
    dTime =(double) (now-lTime);  
  
    //menghitung nilai error  
    error = setPoint-rpm;  
  
    //kalkulasi sinyal PID  
    sError =(sError+error);  
    dError = (error-lError);  
    PID = (kP*error)+((kI*sError)*(dTime/1000))+((kD*dError)/(dTime/1000));  
  
    //sinyal PID dikonversi menjadi derajat pergerakan servo  
    konversi=PID/133; //133 dari pengujian servo terhadap gas engine  
    deg=ldeg+(konversi);  
    if (deg<40)//derajat minimum
```



```
{  
    myservo.write(40);  
  
}  
  
else if (deg>80)//derajat maksimum  
{  
    myservo.write(80);  
}  
  
else  
{  
    myservo.write(deg);  
}  
  
if (cnt==1200)//waktu pengambilan  
{  
    myservo.write(40);  
    delay(300000);  
}  
  
lError = error;  
lTime = now;  
ldeg = deg;  
  
Serial.println(rpm);  
delay(25);  
}  
}
```



LAMPIRAN 3

DATA SHEET



The template features a large, light gray circular emblem centered on the page. The emblem contains a traditional Javanese motif of a central figure flanked by two smaller figures, all holding torches. The words "UNIVERSITAS BRAWIJAYA" are written in a bold, sans-serif font around the perimeter of the circle. The entire emblem is set against a background of a repeating watermark pattern of the university's name.

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