

LAMPIRAN-LAMPIRAN

Lampiran 1. Kode Program Sitem Kendali PI Ganda Pada KDDTT

```
#include <STM32F4ADC.h>

STM32ADC inADC(ADC1);

int count, car, car1, car2;
int mod_final;
int vact, iact, err, err_v, iref;
double itg, lastitg, pi, mod, Bmod, P, I;
double vref, itg_v, lastitg_v, pi_v, P_v, I_v;
uint8_t analog_pins[] = {PA0, PA1, PA4};

/* KENDALI PI */
float kp_v = 0.001;
float ki_v = 0.1;
float kp = 0.001;
float ki = 0.1;

void setup()
{
    for (uint8_t x = 0; x < sizeof(analog_pins); x++)
        pinMode(analog_pins[x], INPUT_ANALOG);

    Timer5.init();
    Timer5.pause();
    Timer5.setMasterMode(TIMER_MASTER_MODE_UPDATE);
    Timer5.setPeriod(10000);
    Timer5.setMode(TIMER_CH2, TIMER_OUTPUT_COMPARE);
    Timer5.setCompare(TIMER_CH2, 1);
    Timer5.attachInterrupt(TIMER_CH2, INT1);
    Timer5.refresh();
    Timer5.resume();

    Timer3.init(); //PWM timer
    Timer3.setPeriod(20);
    Timer3.refresh();

    Timer4.init();
    Timer4.setPeriod(20);
    Timer4.refresh();
    Timer4.setCount(1689);
```

```

Timer3.resume();
Timer4.resume();

pinMode(PB0, PWM);
pinMode(PB6, PWM);
pinMode(PB7, PWM);
pinMode(PB8, PWM);
inADC.setSamplingTime(ADC_SMPR_3);
inADC.enableDMA();
vref = 0;
}

void loop()
{
  while (1)
  {
    sensor();
    Control();
  }
}

void INT1()
{
  vref=2850;
  if (vref > 4000)
  {
    vref = 4000;
  }
  if (vref < 0)
  {
    vref = 0;
  }
}

void sensor()
{
  vact = map(analogRead(PA0), 0, 4095, 0, 4000); //v actual
  iact = map(analogRead(PA1), 0, 4095, -2000, 2000); //act arus
  //vref = map(analogRead(PA4), 0, 4095, 0, 4000); //v ref
}

void Control()
{
  //refv = 4000;
  err_v = vref - vact;
  P_v = kp_v * err_v;
  itg_v = lastitg_v + err_v * 0.0001;
  I_v = ki_v * itg_v;
  pi_v = P_v + I_v;
}

```

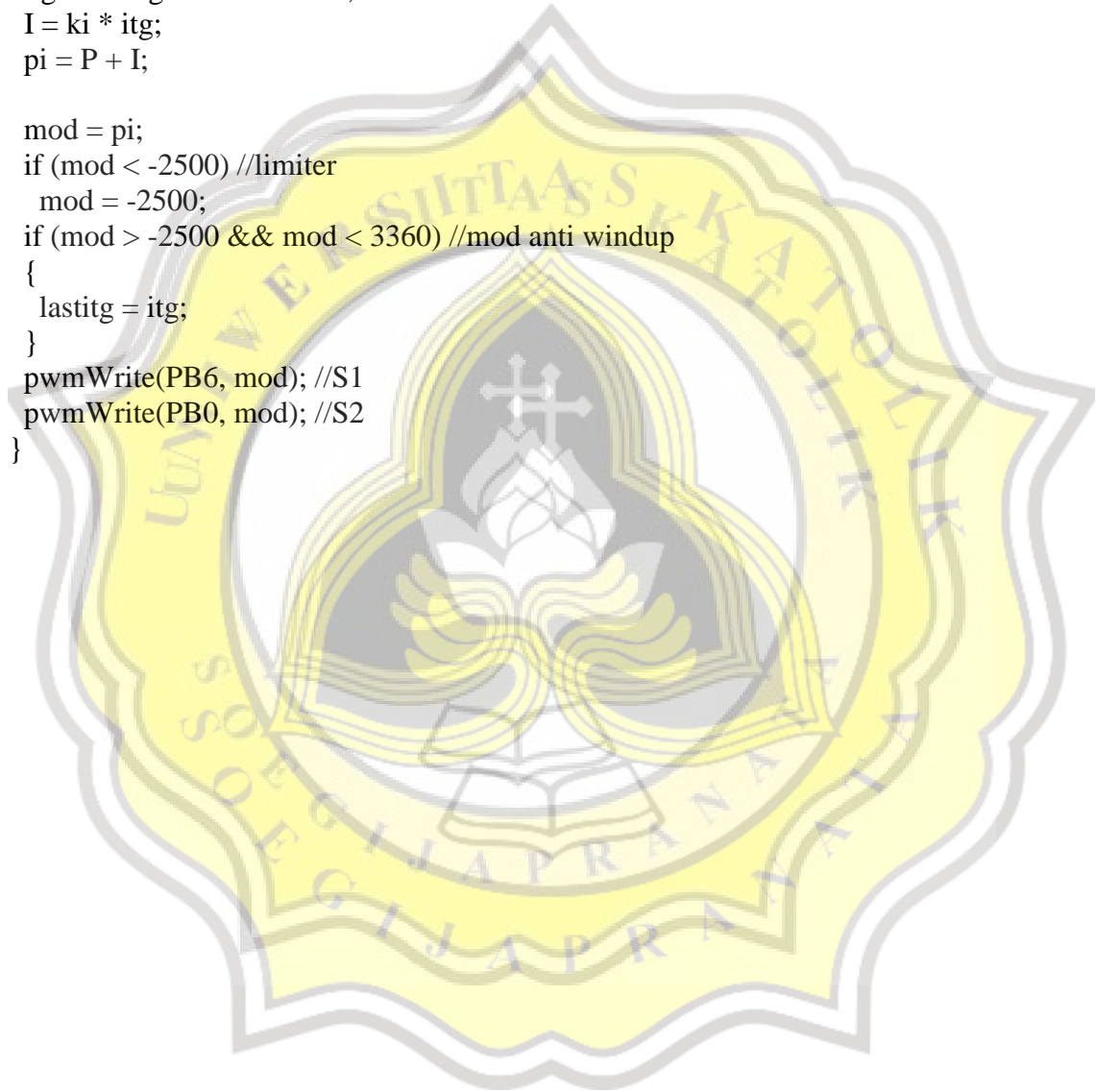
```

if (pi_v > -2000 && pi_v < 2000) //current anti windup
{
  lastitg_v = itg_v;
}

iref = pi_v ;
err = iref - iact;
P = kp * err;
itg = lastitg + err * 0.0001;
I = ki * itg;
pi = P + I;

mod = pi;
if (mod < -2500) //limiter
  mod = -2500;
if (mod > -2500 && mod < 3360) //mod anti windup
{
  lastitg = itg;
}
pwmWrite(PB6, mod); //S1
pwmWrite(PB0, mod); //S2
}

```



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