# LAMPIRAN

**Lampiran -1** Program Alat

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_HMC5883_U.h>
#include <Stepper.h>

// ======== Konfigurasi ========
const int   STEPS_PER_REV   = 2048;
const float TARGET_AZIMUTH  = 292.0;
const float TOLERANCE       = 0.5;
const int   STEP_SPEED_RPM  = 10;

const int IN1 = 8;
const int IN2 = 9;
const int IN3 = 10;
const int IN4 = 11;

// ======== Objek ========
Adafruit_HMC5883_Unified mag(12345);
Stepper stepper(STEPS_PER_REV, IN1, IN3, IN2, IN4);

int lastDirection = 0; // 1 atau -1, untuk menyimpan arah koreksi
terakhir
int i = 0;

void setup()
{
  Serial.begin(9600);
  if (!mag.begin())
    {
      Serial.println("ERROR: HMC5883L tidak terdeteksi!");
      while (true);
    }
  stepper.setSpeed(10);  // boleh dihilangkan
}

void loop()
{
  //baca sudut sensor ------------------------------------
  sensors_event_t event;
  mag.getEvent(&event);
  float mx = event.magnetic.x;
  float my = event.magnetic.y;
  float heading = atan2(my, mx);
```

```
  if (heading < 0) heading += 2.0 * PI;
  float headingDeg = heading * 180.0 / PI;

  //hitung error----- -------------------------------------
  float error = TARGET_AZIMUTH - headingDeg;
  if (error > 180.0) error -= 360.0;
  else if (error < -180.0) error += 360.0;

  //putar motor----- -------------------------------------
  int dir;
  if (abs(error) > 10 * TOLERANCE)
    {
      dir = (error > 0) ? 15 : -15;
      lastDirection = dir;
      stepper.step(dir);
      i = i + 1;                      //hitung step ---------

      //tampilkan data---------------------------------------
      Serial.print(i);
      Serial.print("  ");
      Serial.print(headingDeg);
      Serial.print("  ");
      Serial.println(error);
    } else
  if (abs(error) > TOLERANCE)
    {
      dir = (error > 0) ? 1 : -1;
      lastDirection = dir;
      stepper.step(dir);
      i = i + 1;                      //hitung step ---------

      //tampilkan data---------------------------------------
      Serial.print(i);
      Serial.print("  ");
      Serial.print(headingDeg);
      Serial.print("  ");
      Serial.println(error);
    }

  // Reset step jika sudah sejajar
  if (abs(error) <= TOLERANCE) {
    i = 0;
    stepper.step(0);
  }
  delay(100);  // bisa dihilangkan
}
```