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Direct current processing in DC motor using arduino and peak value method

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ABSTRACT

The research proposes about monitoring current of Direct Current (DC) Motor using microcontroller, current sensor and peak value method. The device is Arduino Uno R3 microcontroller, current sensor INA 219, motor driver L298, DC motor JGA25-370 and computer. The algorithm detects the inrush of the DC Motor Current. In the experiment result, the device can measurement the current sensor by varying the Pulse Width Modulation (PWM) such as 50-150. The method can avoid the zero current value. Thus, the proposed method could be implemented for monitoring the direct current of DC Motor.

Keywords
Current Sensor
Arduino
DC Motor
Current Monitoring

1. Introduction

DC Motor have a lot of application such as robotics [1], conveyor [2], automation [3] and mobile robot [4]. One of the most important things in observing the performance of a DC motor is observing angular speed [5] and the current flowing [6]. The electric current is proportional to the torque produced by the DC motor so that the greater the motor torque will cause the electric current [7]. Therefore, a monitoring system is needed to observe the current value of a DC motor.

The method for observing electric currents is monitoring using a microcontroller such as the Arduino [8][9]. Monitoring with Arduino is better than monitoring with conventional methods. This is because current data can be stored in memory and displayed on websites with the concept of the Internet of Things (IoT) [10], SMS [11][12] or Telegram [13][14]. With this concept, monitoring can be done anytime and anywhere.

Arduino have a lot of application such as robotics [15][16][17][18], temperature monitoring [19], voltage monitoring [20], home security [21], ripeness of fruit [22], fluid level measurement [23] and medical [24]. Thus, it will sufficient to implemented for current monitoring in DC motor because it has a lot of application in various field.

The rest of paper was as follow. The first section was introduction. The second section was method that consist of system design and algorithm. System design explain about block system diagram, wiring diagram and input output PIN. The third section was result and discussion and the last section was conclusion.

2. Method

2.1. System Design

The block diagram system was shown in Fig. 1. The wiring diagram was shown in Fig. 2. The input output PIN was shown in Table 1. The system consists of DC Motor, Microcontroller, Current Sensor and Computer.

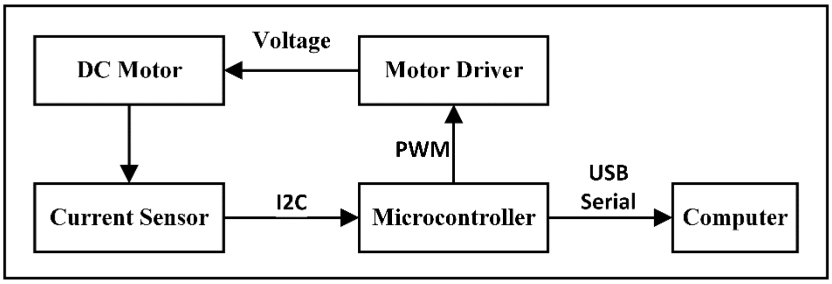

Fig. 1. Block diagram system

In Fig. 1, the microcontroller is Arduino Uno R3, the DC Motor is JGA25-370 with 200RPM. The current sensor is INA219. The other current sensor is ACS712 but is cannot give the good measurement [25]. The current sensor and microcontroller used I2C communication to send the data. The driver Motor is L298.

The driver motor L298 have three input that is PWM PIN, first input logic and second input logic [26]. The current sensor INA219 have two input that is SDA and SCL [27]. It connected to the pin Arduino in A4 and A5.

In Fig. 2, the main power supply was coming from Power Supply Unit (PSU) 12VDC. There are two kind of system voltage. The first was 12V to supply the microcontroller and DC motor via motor driver. The second was 5V to supply the current sensor and motor driver IC.

Table 1. Input and output PIN

Arduino PIN	Device
A4	SDA (INA219)
A5	SCL (INA219)
5	PWM (L298)
4	Input Logic (L298)
3	Input Logic (L298)

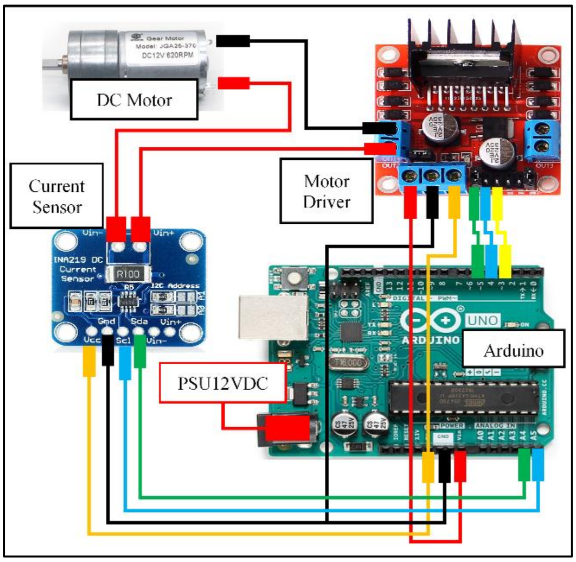

Fig. 2. Wiring diagram

2.2. Algorithm

The algorithm is shown in the flowchart in Fig. 3. The first is about initialization the variable, the data types, and the serial communication. The main program measured the DC motor current in some data then select the largest value. The largest value is sent to the computer in serial monitor/ serial plotter. the process runs continuously until the system is turned off.

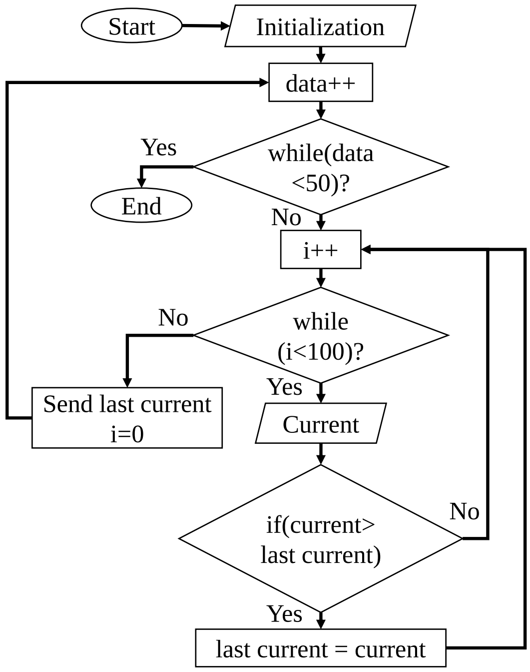

Fig. 3. Algorithm in flowchart

The Arduino program based on the flowchart is shown in Fig. 4.

```
#define PWM 6
#define in1 7
#define in2 8 #include <Wire.h>
#include <Adafruit_INA219.h>

Adafruit_INA219 sensor219;
float shuntvoltage = 0; float loadvoltage = 0;
float busvoltage = 0; float current = 0; float
power = 0;
float data_current = 0; float data_voltage = 0;
int motorSpeed = 0; int data = 0;
int i=0;

void setup()
{
  Serial.begin(9600); sensor219.begin();
  pinMode(PWM,   OUTPUT);   pinMode(in1,   OUTPUT);
  pinMode(in2, OUTPUT);
  digitalWrite(in1, LOW); digitalWrite(in2, HIGH);
  sensor219.setCalibration_16V_400mA(); motorSpeed=50;
}
void loop() { while((data<=100))
 {
    analogWrite(PWM, motorSpeed);

    for(i=0;i<100;i++)
    {
      current =abs(sensor219.getCurrent_mA()/1000); if(current > data_current)
      {
         data_current = current;
      }
    }
    Serial.print(motorSpeed); Serial.print(",");
    Serial.print(data_current); Serial.println();
    data++;
  }
  analogWrite(PWM, 0);
}
```

Fig. 4. Arduino program

3. Result And Discussion

The device was shown in Fig. 5. There is adaptor power supply 12v 2A, Arduino Uno, DC Motor JGA25, Driver Motor L298, Current Sensor INA219 and USB cable to computer.

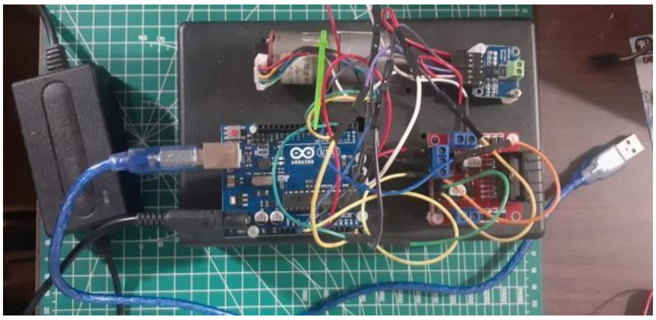

Fig. 5. Hardware experiment

The current sensor reading result with PWM 50 is shown in Fig. 6. The result using the proposed method is shown in Fig. 7. The axis is data number and current value. The data was coming from serial monitor and the data was plotting using Matlab.

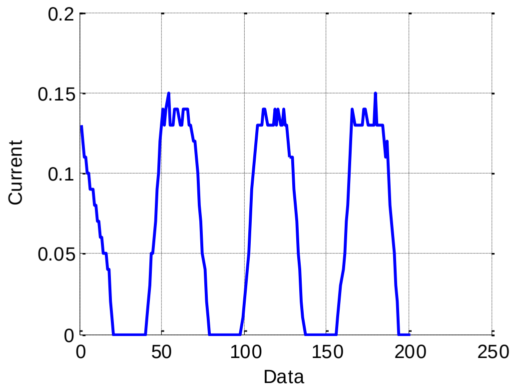

Fig. 6. Examination with PWM 50

In Fig. 6, it can be show that the current result is unstable. Thus, we need some method to improve the stability. There is a peak current value that must be taken and remove the zero data.

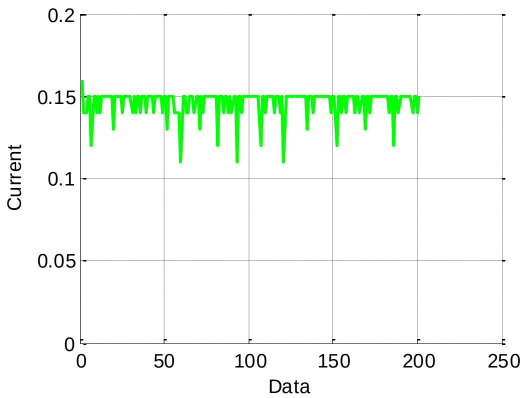

Fig. 7. Examination with PWM 50 and Peak Value Method

In Fig. 7, the better result can be obtained using the proposed method. The current data is more stable and does not have the zero value. Thus, the proposed method is recommended to remove the unstable value.

The next examination is observing with various PWM. The result is shown in Fig. 8. The PWM value is between 50-150 with increasing by 10.

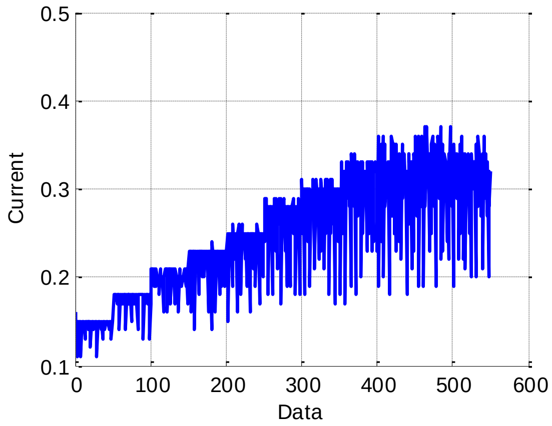

Fig. 8. Examination with PWM 50-150

In Fig. 8, the proposed method can measurement the current without the zero value. The current is proportional to the PWM. But, in the up to 130, the current has the almost same value.

4. Conclusion

The paper proposes about current monitoring in DC Motor using peak value method. In the experiment, it can be known that the sensor can measure the current but having the unstable current result. By using the peak value method, the result is better and avoiding the zero value. Thus, the method is recommended in DC motor current monitoring.

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