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Task : 3 (Brushless motor)

Introduction :

It often helps to explain how a brushed DC motor works first, as they were used for some time before brushless DC motors were available. A brushed DC motor has permanent magnets on the outside of its structure, with a spinning armature on the inside. The permanent magnets, which are stationary on the outside, are called the stator. The armature, which rotates and contains an electromagnet, is called the rotor.

In a brushed DC motor, the rotor spins 180-degrees when an electric current is run to the armature. To go any further, the poles of the electromagnet must flip. The brushes, as the rotor spins, make contact with the stator, flipping the magnetic field and allowing the rotor to spin a full 360-degrees.

A brushless DC motor is essentially flipped inside out, eliminating the need for brushes to flip the electromagnetic field. In brushless DC motors, the permanent magnets are on the rotor, and the electromagnets are on the stator. A computer then charges the electromagnets in the stator to rotate the rotor a full 360-degrees.

The circuit diagram :

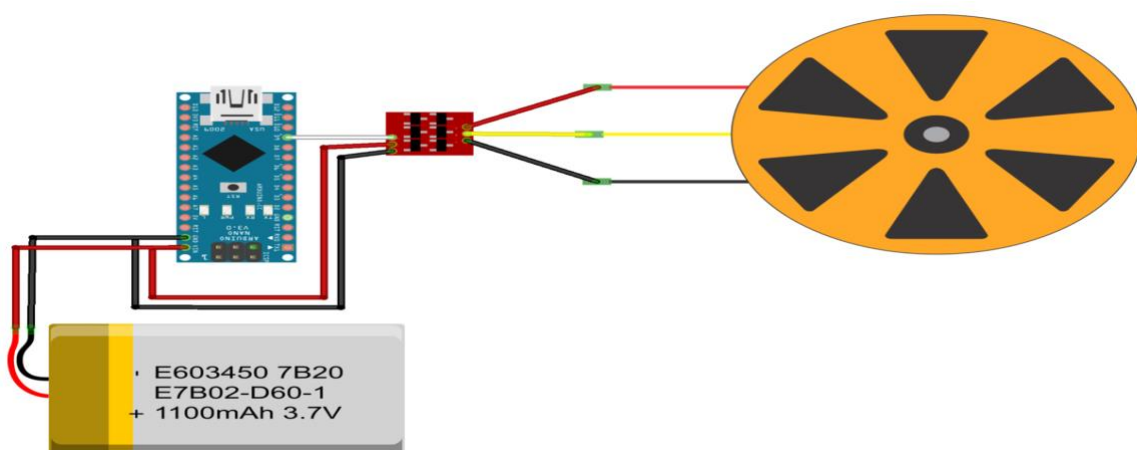


Figure : 1 (I used this circuit Design with Tinkercad)

The components :

- Computer
- Arduino UNO
- USB cable A Male to B Male
- Brushless+ESC

The code used :

```
//Parametersconst int escPin = 3;int min_throttle = 1000;int max_throttle = 2000;unsigned long currentMillis, previousMillis;void setup() { //Init Serial USBSerial.begin(9600); Serial.println(F("Initialize System")); //Init ESC pin Mode(escPin, OUTPUT); initProcedure(); } void loop() { runBrushless(); } void runBrushless() { /* function runBrushless */ // Test Brushless routine Serial.println("running"); currentMillis = 0;

previousMillis = millis(); while (currentMillis < 2000) { currentMillis = millis() - previousMillis; digitalWrite(escPin, HIGH); delayMicroseconds(1350); digitalWrite(escPin, LOW); delay(20);

} Serial.println("stop"); currentMillis = 0;

previousMillis = millis();

while (currentMillis < 2000) {

currentMillis = millis() - previousMillis;

digitalWrite(escPin, HIGH);

delayMicroseconds(min_throttle);

digitalWrite(escPin, LOW);

delay(20);

} void initProcedure() { /* function initProcedure */ // ESC initialisation process previousMillis = millis(); Serial.println("throttle up");

while (currentMillis < 3000) {
```

```
currentMillis = millis() - previousMillis;

Serial.println(currentMillis);

digitalWrite(escPin, HIGH);

delayMicroseconds(max_throttle);

digitalWrite(escPin, LOW);

delay(20);

} //beep- beep-

currentMillis = 0;

previousMillis = millis();

Serial.println("throttle down");

while (currentMillis < 4500) {

    currentMillis = millis() - previousMillis;

    Serial.println(currentMillis);

    digitalWrite(escPin, HIGH);

    delayMicroseconds(min_throttle);

    digitalWrite(escPin, LOW);

    delay(20);

} // beep--

// 1 2 3

}
```