Brushless Motor And Encoding

First We Have To Know The Difference Between Motor And Generator?

Generator: Convert From Kinetic Energy To Electrical Energy.

Motor: Convert From Electrical Energy To Mechanical Energy, Specifically Kinetic Energy.

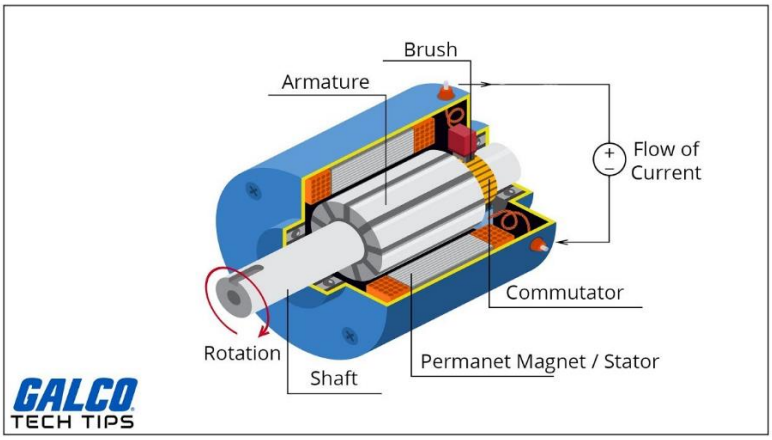
As We Can See In Figure 1, Some Examples Of The Motor

Fig.1. Brush Motor or Dc Motor.

What is the difference between Brush Motor and Brushless Motor?

Each motor has two parts, a rotating part and a fixed part.

In the case of the Brush Motor:fig.2



We see that the rotating part is the shaft connected to the magnets inside the motor

And the stator is the other part of the motor responsible for giving current to the work of the electric circuit and the generation of the magnetic field, and this is the way to move these two types of motor, but we will talk about it later.fig.3

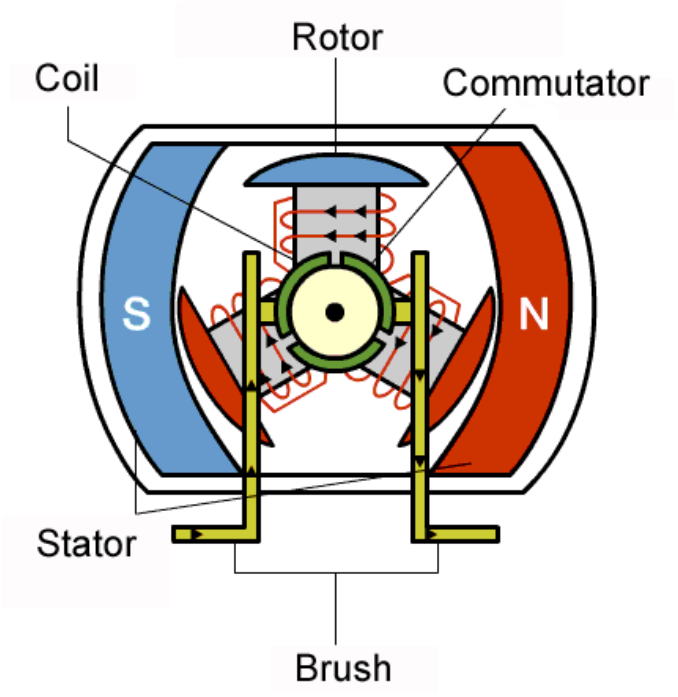


Fig.3

But there is a problem, which is the Brush, which is responsible for determining the stator part with the electric current, and the problem with it is that it is connected to the rotating part. Defining the commutator, which causes friction over time, so the scientists thought of a way to find a way to solve this problem and its solution is known as the Brushless Motor mean without the brush.

Brushless Motor

Fig.4. Brushless Motor

Where in this case the stator are the coils and they are divided into three parts

And 3 wires a, b and c appear from it

The moving part is the magnets

So there is no brush here.

How it works

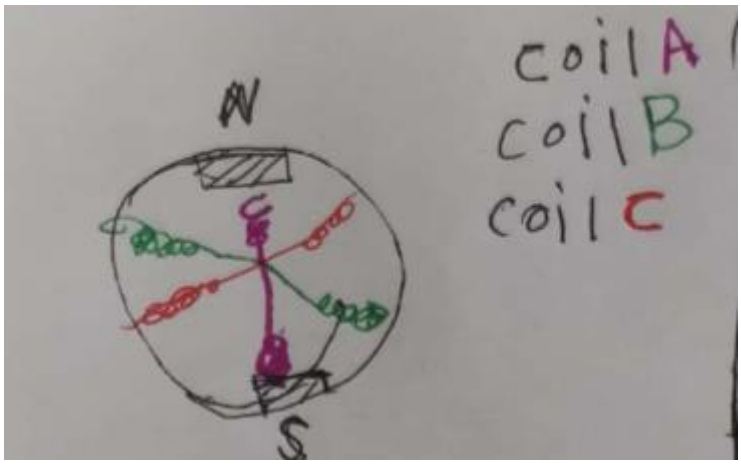


Fig.5a. To simplify how it works

If we give one of the coils an electric current, then a magnetic field is generated for us

So, if we give coil A and there is a magnetic field as in Figure 5b, they will repel each other, and if we give coil C an electric current and there is a magnetic field as in Figure 5b, they will attract and thus turning on and off this is how it works simply.

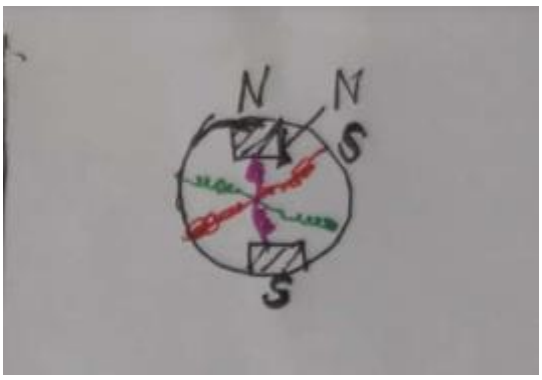


Fig.5b

As we can see also in Figure 6.

Here we see that the magnets are inside the coils, but I will talk about the motor in Figure 4, but this is an animation of how it works.

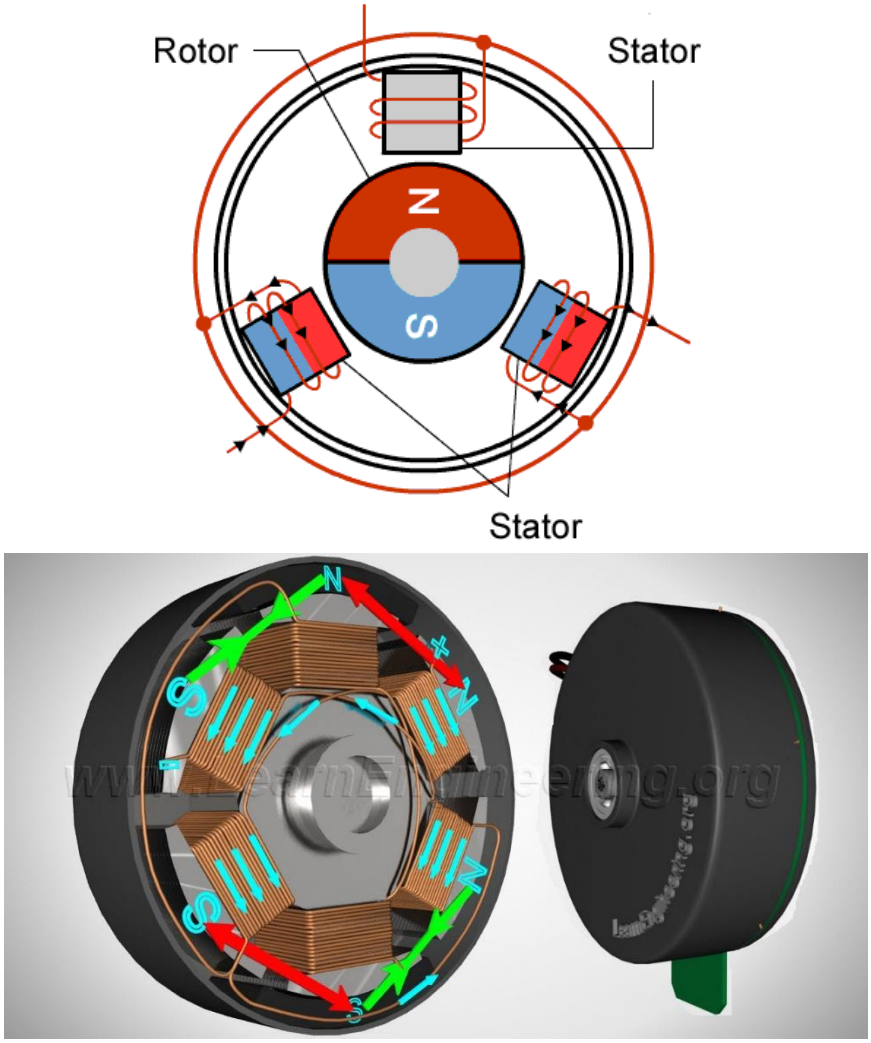


Fig.6

In the case of Figure 5b, the movement of the shaft will be in a clockwise direction, but if we want it to be counterclockwise, we reverse the steps, and according to which we have switched to running C, we turn on B as we talked about before and as we see Figure 5c

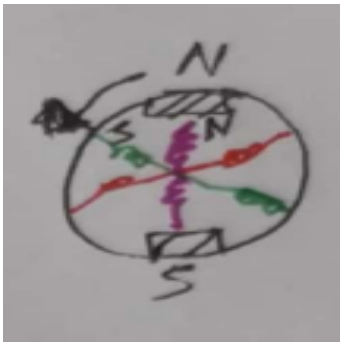


Fig.5c

Pulse Coding And Signal

If we want to draw the signals or the pulse emanating from passing the electric current in the coils, we will get the following diagram Figure 7, and as we can see that in the first case we passed a current in coil A and the rest is zero, then after that B and the rest is zero and also with C and after that in order for coil A to repel with the south At the bottom it has to be south as well. This is why we will reverse the direction of the current in coil A and it will be negative. This is why we see in Figure 7 the red signal moving downwards, which means that it is negative, and so it is a series of repeated sequences to obtain a rotating movement from electrical energy.

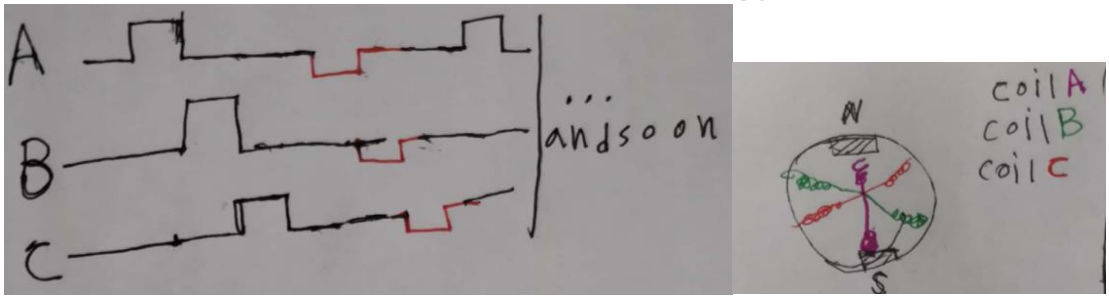


Fig.7

But if we do A and B and leave C as we previously talked about running one coil, but here we run two coils like us A is north and B is south in order to repel A and attract with B and so on in order to obtain greater torque and speed as we see in Figure 8 the six main sequences, for example in the first We run A and give it a positive char, and C is ground, and in the second step we leave C as it is and do B and so on, but we will notice that the seventh step is the same as the first step. For this, these are the main sequences, and then they are repeated again. In Figure 9 we see the signals as we saw them before, but now with two runs.

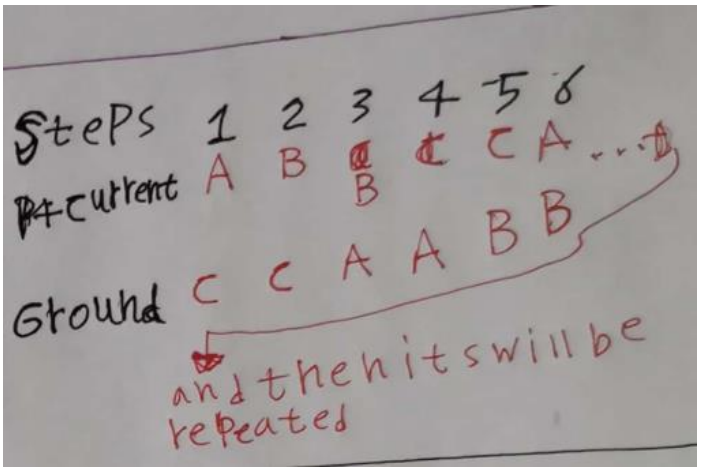


Fig.8

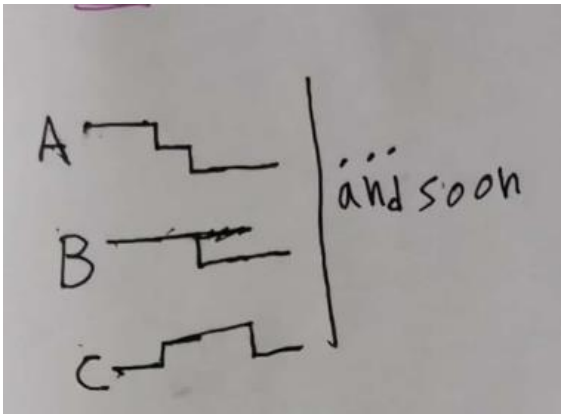


Fig.9

But how do you do this movement and do it quickly?

Through the transistor, as in Figure 10, we see in Figure 10 the state or the first step, which is to activate A with a positive current and ground C, and B will be floating, i.e. free, meaning that no positive current passes through it and not free ground.

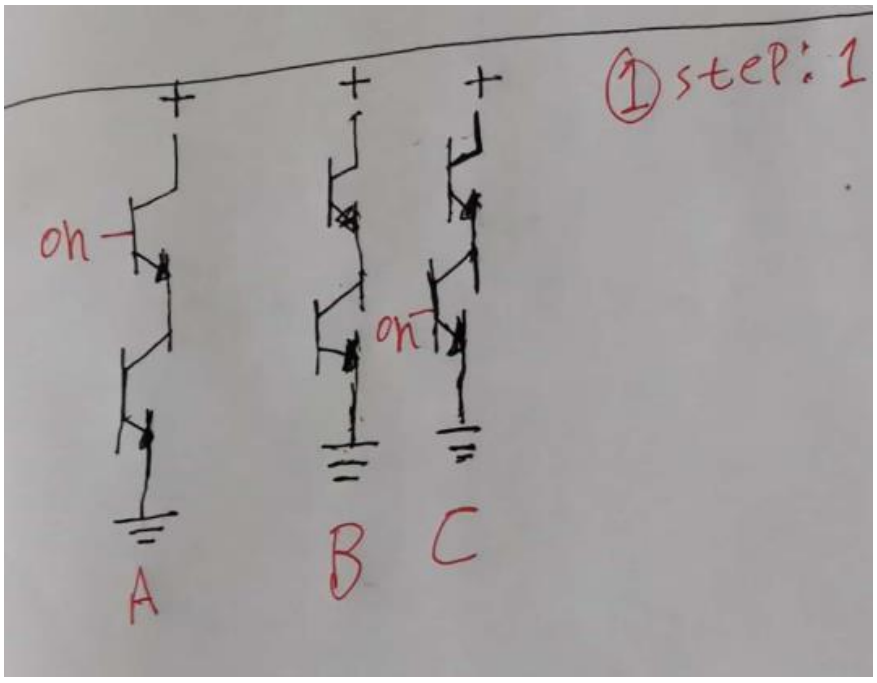


Fig.10

But who transferred from one case to another? Move if the coil gets close to the magnet before it reaches it?

We have to use the hall effect sensor Figure 11

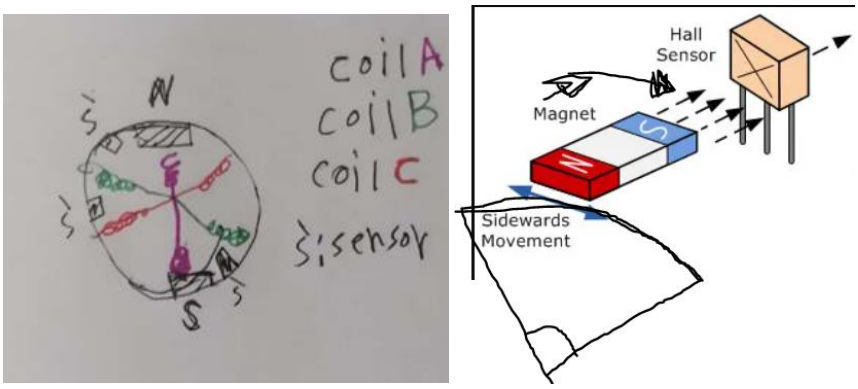


Fig.11

But some engines do not have these sensors, so we have to use Electronic Speed Controller (ESC) As we can see in Figure 12

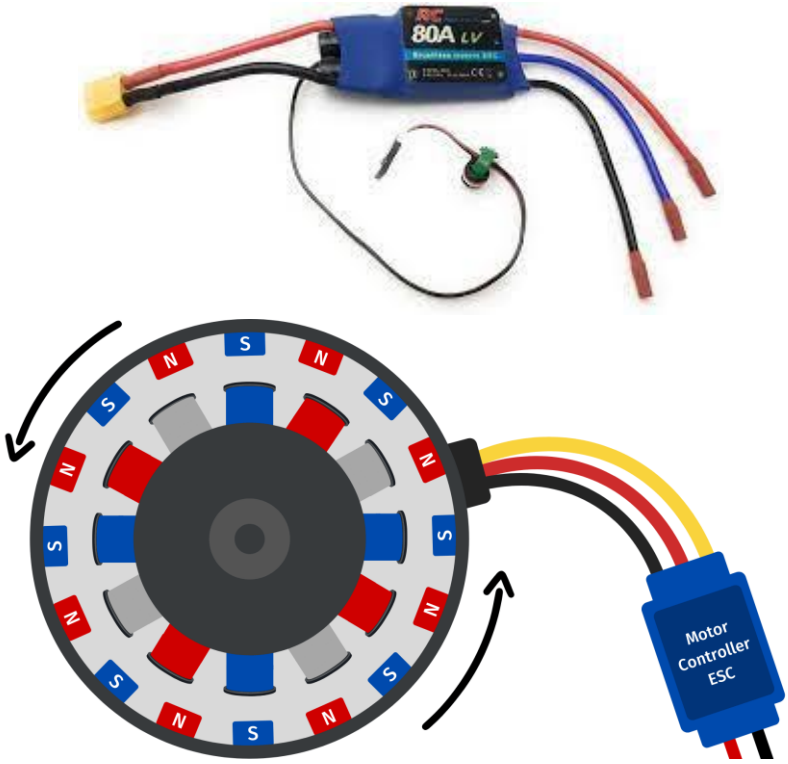


Fig.12

It works using the BEMF principle

Suppose we started in the first case, as in Figure 8. This means that the current will pass from A to C, but thus a magnetic field will be generated and will be sensed by the coil B and will be transferred from one state to another, and so on.

It is suitable for small engines with high speeds.

But we have to know how to read the information on the motor as in Figure 13

Fig.13

Where the diameter of the motor in Figure 13 is 22 mm in diameter, the motor part is the silver part, and the height is 12 mm, the dead part is also the motor part, and 13T means eating a coil of coils wrapped 13 times

What does the number of files mean?

The greater the coils, the greater the torque, but in return the speed decreases, and vice versa

1000KV means 1000rpm/v, meaning that if the voltage is one winding the motor 1000 rpm and so on.

We can make a simple diagram block for control In Figure 14

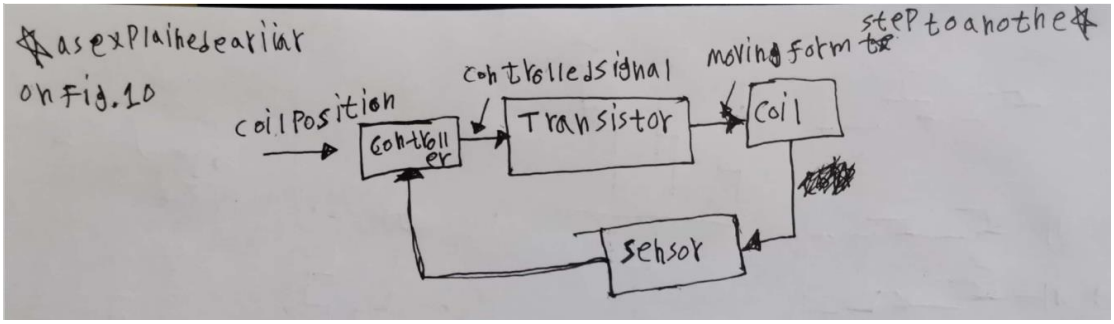


Fig.14

We can control it using the Arduino, and this is what I will learn during the training

Thanks for reading