Spy Bird (A Mechanical Radio-Controlled Bird)

Ch. Srigiri[*1], Putrevu Lakshmi Gana Ravi Chandra Phani [*2], Maturi Divya [*3], Vandana Bhagya Sai [*4]

[1,]Assistant Professor, Department of Electronics and Communication Engineering, Godavari Institute of Engineering and Technology (A), Rajahmundry, Andhra Pradesh, India

[2,3, 4,]UG Students, Department of Electronics and Communication Engineering, Godavari Institute of Engineering and Technology (A), Rajahmundry, Andhra Pradesh, India.

Abstract: Now-a-days surveillance at borders became very crucial part, although our soldiers do 24hrs patrol but sometimes, they may miss some intruders, because of that they use drones and surveillance cameras instead of direct man force sometimes. But for special combat missions and special surveillance if we use drones, they get caught and also, we can't implement CCTV surveillance cameras everywhere. For that reason, using Bernoulli's and Newton's third law of motion principle we are designing a drone which is in the shape of bird and usually called as Ornithopter for surveillant purpose. using this spy bird, they can watch the things without direct man patrol and it can be in hidden manner so that no can differentiate between the real and mechanical bird, so that no soldier need not to patrol alone at borders all the time. Finally using these spy birds, they can have eyes on target without reaching themselves directly and without knowing the things what is they are up to.

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INTRODUCTION

An ornithopter (Spy Bird) is an aircraft that flies by flapping its wings, i.e., it can also be defined as an aircraft that derives its force and upraise from the mechanism of flapping wings. spy bird imitate nature as no natural creatures have any rotating parts. Engineers and researchers have experimented with wings that require carbon fibre, play wood, fabric, ribs and the trailing edge to be stiff, strong and for the mass to be as low as possible. Unlike airplanes and helicopters, the driving air foils of the spy bird have a flapping or oscillating motion, instead of rotary motion. As with helicopters, the wings usually have a combined function of providing both upraise and force. Theoretically, the flapping wing can be set to zero angle of attack on the airlift, so it transits the air. Since typically the flapping air foils produce both lift and thrust, drag-including structures are minimized. these two trump cards certainly allow a high degree of efficiency.

LITERATURE REVIEW

The Sanskrit epic Ramayana (4th Century BC) describes an ornithopter (Spy bird), the Pushpaka Vimana. Using this technique so many researchers tried to achieve flapping-wing flight but only a glide was actually achieved. After many researches the first ornithopter were constructed in France.

Using this technique, the ornithopter re-designed for spying instead of travelling purpose.

- In 1984, the ornithopter (Spy Bird) Patrick Deshaye started the society.
- I preferred this society's blog as reference to my Spy Bird which is similar to ornithopter.
- The main variation here is, in the blog they mentioned only about the flying mechanism. But we added the surveillance too from the general drone's mechanism.
- Other references like instructables, design of ornithopter by Zachary John Jackowski followed.
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MODELING AND ANALYSIS

The main moto here is to achieve flight in our spy bird, so we used principles like Bernoulli's and Newton's Third law of motion and we kept some basic and important parts in this section.

Here we are going to show you the output from Arduino IDE by using serial monitor and also, we are going to provide you the two main important codes needs to implement flight using wings (indirectly using DC BLDC motor) and flip towards left or right using tail (indirectly using Servo motor).

Bernoulli's Principle:

Bernoulli's principle is a seemingly counterintuitive statement about how the speed of a fluid relates to the pressure of the fluid. Many people sense like Bernoulli's philosophy should not be accurate but perhaps due to a misinterpretation about what Bernoulli's philosophy literally says is:

Bernoulli's principle states that the faster a fluid travels the lower pressure it will produce. This comes into effect when the shape of the wing on the aircraft has a bigger curvature on crest of the wing than the rear end because it creates more plane area on crest of the wing. When air (the fluid) flows over the wing it takes longer to go over the crestplane than the rear end so the speed of the air on crest of the wing must be more significant in order to travel a farther distance during the same interval. This imbalance of airspeeds on top and bottom creates a lower pressure on top of the wing therefore lifting the wing up into the air. In order for the wing to produce elevate it needs airspeed. In an ornithopter, the airspeed in generated by the flapping of the wings. Newton's third law of motion will describe how it flaps wings.

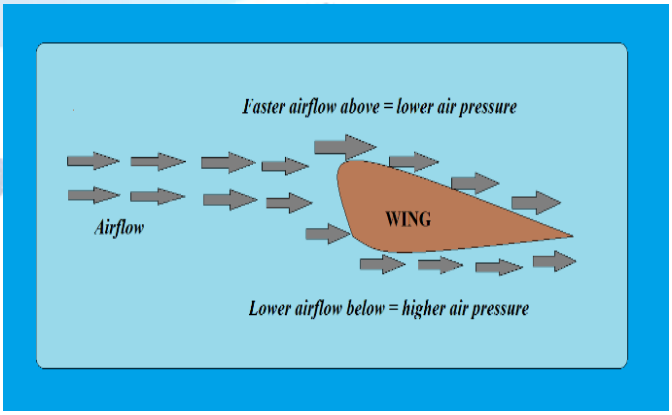

Figure 1: Bernoulli's Principle

Newton's Third law of motion:

In an ornithopter, the airspeed in generated by the flapping of the wings. Newton's third law of motion will describe how the flapping works. Newtons Law

says that for every action, there is an equal and opposite reaction. When the wing on the Ornithopter flaps down it pushes down on the air which pushes the Ornithopter upwards.

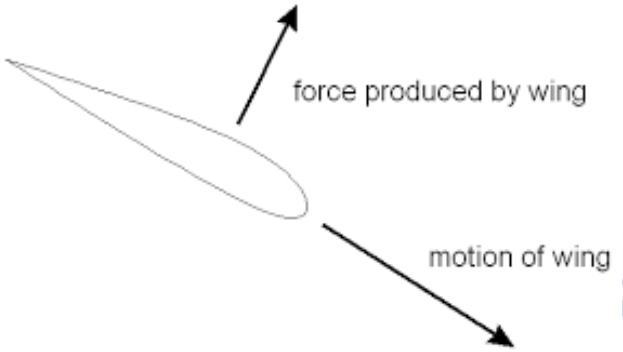

Figure 2:Principle reflects to wing mechanism

Basic Parts:

Gear Box:

In Spy bird, gear mechanisms are used in order to provide sufficient spin to flap the wings. A toothed wheel is a rotating machine part having tooth like structure around the wheel. Which mesh with another toothed part in order to transmit revolution. Two or more gears working in buggy are called a transmission and can produce a mechanical lead through a gear ratio and thus may be considered aneasy machine. The most common situation for a gear to mesh with another gear; however, a gear can also mesh a stationary toothed part, called a rack, thereby producing relocation instead of rotation.

Body:

In general, the frame of the body of a Spy bird is made of balsa wood and carbon. In order to minimize the weight of the Spy bird Styrofoam is stuck in the gap of the body frame, appropriately sized gaps for placing micro controller board, receiver and servos.

Wings:

For a Spy bird to be effective it should be capable to flap its wings to generate enough power to get off the ground and travel through the air. Efficient flapping of the wing is characterized by the pitching angles, lagging plunging displacements by approximately 90 degrees. To increase efficiency of the Spy bird more power is required on the down stroke than on the upstroke. Here we are going to use BLDC motor to achieve this wing mechanism.

About BLDC Motor:

It converts electrical energy into rotational motion. BLDC motors provide higher efficiency and require lower maintenance. The rotational motion is caused through the seduction and repulsion of magnetic poles of everlasting and electromagnets. BLDCs require a complex controller to convert a single DC power to three-phase voltage, whereas a brushed motor can be controlled by regulating the DC voltage. A BLDC motor is a kind of flipped version of a brushed motor because the permanent magnets are installed in the rotor, whereas the coil windings become the stator. BLDC motors are permanent magnets in the rotor and are defined as synchronous motors. In a synchronous motor the rotor is synchronized with the stator magnetic field i.e., the rotor turns at the same speed as the stator magnetic field. Back EMF is an important characteristic of a motor as its shape dictates the kind of algorithm required to optimally control it. Due to their design, BLDC motors have a trapezoidal back EMF shape and are commonly controlled by trapezoidal communication

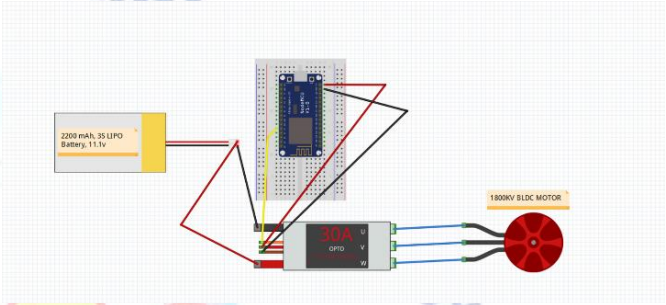

Figure 3:Brushless Motor Interfacing with Nodemcu

Code for wings mechanism (to control BLDC motor via Nodemcu module using blynk application):

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <Servo.h>
// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "edDzhlUNKOJ2_h6dkb_wC0-Rh7toX2tl";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Redmi";
char pass[] = "          ";

Servo ESC;

void setup()
{
  // Debug console
  Serial.begin(9600);
  ESC.attach(2,1000,2500);//Pin Number D4
  ESC.writeMicroseconds(1000);
  Blynk.begin(auth, ssid, pass);
}

BLYNK_WRITE(V2){
  int pinValue = param.asInt();
  ESC.write(pinValue);
  Blynk.virtualWrite(V1, pinValue);
  Serial.print("V2 Slider Value is: ");
  Serial.println(pinValue);
}

void loop()
{
```

Figure 4:To Control BLDC Motor

Tail:

In order to steer a Spy bird efficiently and perform turns easily, necessary condition is the stabilization of a free flight Spy bird which depends on its rear end(tail). The tail of a Spy bird is generally in V- shaped tail with an angle of 120 degrees. Two steppers or servos are mounted on the body frame to move the rudders attached to the tail, is used to change the direction and pitch of the Spy bird. Here we are going to use servo motor to control the turns related to tail.

About Servo motor:

A servo motor is a type of motor that can rotate with great precision. If we want to steer an object at some particular angles or distance, then we use a control(servo) motor. A servo motor usually comes with a gear positioning that allows us to get a very high revolution servo motor in small and lightweight combinations. Due to these qualities, they are being used in many applications like Remote Cars, planes and helicopters by radio controllers, Robotics.

Interfacing servo motor with µ-controller:

Interfacing Servo motors MCU is very easy. Servos have literally three wires. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.

Controlling Servo Motor:

Servo motor is controlled by pulse width modulation (PWM). which is provided by the control cords. There is a min pulse, a max pulse and a pulse repetition rate.

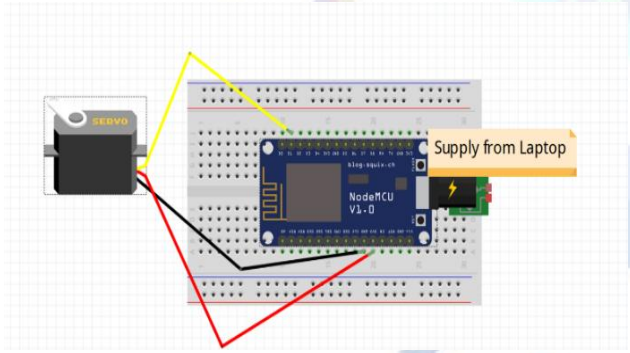

Figure 5: Interfacing Servo Motor with Nodemcu

The above circuit diagram is the interfacing the servo motor with the wi-fi module called Nodemcu, by using blynk program which is written in Arduino IDE as shown below, it is used to control this servo motor.

Code for tail mechanism (to control the servo motor via Nodemcu using blynk application):

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <Servo.h>
// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = "jIcoBdqhQTy3ZnLg_0YgX_9Q9ZV-ErBK";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "GPONWIFI_6648";
char pass[] = "0000006646";
Servo servo;


void setup()
{
  // Debug console
  Serial.begin(9600);
  servo.attach(2);
  servo.write(60);
  Blynk.begin(auth, ssid, pass);
}

BLYNK_WRITE(V3){
  int x = param[0].asInt();
  int y = param[1].asInt();
  servo.write(x);
  Blynk.virtualWrite(V0,x);
}
void loop()
{
  Blynk.run();
```

Figure 6: Code to control servo motor

RESULTS

Output for BLDC Motor in Serial Monitor (Arduino IDE):

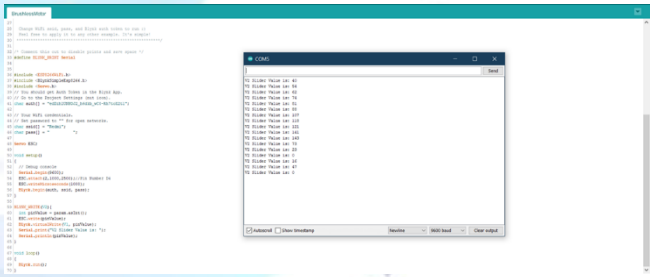

Figure 7: Output in Serial Monitor

The above picture is the result captured by Arduino ide while controlling BLDC motor via blynk application, so we can cleanly observe here that our signals through wi-fi module can be captured by DC motor so that we can control it using blynk application and this DC motor is connected to gear part so that we can obtain wing mechanism.

Blue Print of Spy bird:

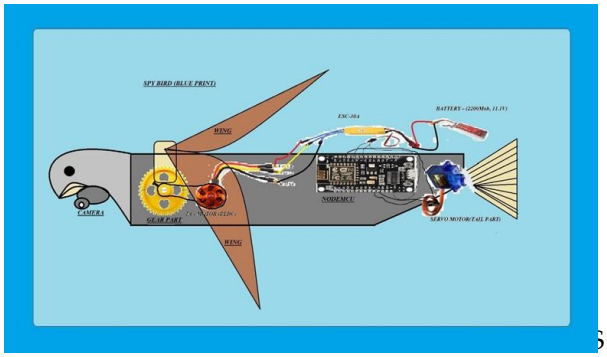

Figure 8: Spy bird's Blue-print

The above picture we have shown is the blue print of our project, and the real one would be al almost exactly similar to this.

CONCLUSION

❖ In this project with the help of few references we are going to design the best spying UAV (Unmanned Aerial Vehicle) in small size. Later it can be modified with better view and experience regarding the design. The main advantage in this project is Thermal Imaging which absorbs the heat signatures of the objects.

❖ Finally, GEAR SET is the most important part and it can be designed in many ways, but the most import parts in the gear set are discussed here.

REFERENCES

1. http://ornithopter.org/
2. http://www.ornithopter.de/english/index_en.htm
3. https://www.instructables.com/Opensource-Ornithopter-Prototype-Arduino-Powered-a/
4. https://www.sciencelearn.org.nz/resources/303-how-birds-fly

