ISSN (Online) 2348 – 7968
www.ijiset.com

Implementation of Aviation Shooting Drones

Ye Hoon Lee

Department of Electronic and IT media Engineering, Seoul National University of Science & Technology, Seoul, 01811, Korea

Abstract

Recently, there have been more and more uses of drones in everyday life. Especially, in the field of broadcasting, it is advantageous to use a drone to easily obtain a screen at a place or angle that a person cannot shoot. In this work, we design a racing drone so that we can see the image in the sight of the drones. Basically, it is designed to control sensor and motor using FC board and to receive the camera signal and display it on the screen. The signal from the transmitter is received at the receiver, transferred to the FC board, and sent to the parts from the FC board. We use a program called *Librepilot* to connect the FC board to the receiver controller. Due to the difference in voltage required for each part, we supply the necessary voltage to the part through the voltage distribution board. The images taken by the drone can be received through the 5.8GHz channel and transmitted through the FPV goggles, and the recorded images can be obtained through the separately installed action cams.

Keywords: *Drone, Shooting, Implementation, FC Board, Librepilot.*

1. Introduction

The Drone, meaning unmanned aircraft, is an unmanned aerial vehicle that literally manages to fly by radio waves without boarding a person. Early drones are developed for training in the army and gradually expanded their use to reconnaissance and offensive missions. The drones are now being used not only for military purposes but also for businesses, media, and individuals, and have grown into a spotlight in the fourth industrial revolution.

Big companies around the world, like Google and Amazon, are also looking to develop and use the new drone technology in recent years. Amazon has already unveiled a new shipping system using the drones in December 2013 and will release the drone delivery service as soon as legal restrictions are lifted. Google acquired a start-up company in 2014 to build a drone and is using the drones to supply wireless internet to the world.

In addition to these global corporations, newspapers, broadcasting companies and movie production companies are shooting drones as photographic equipment. Recently, as the kid industry has developed, various products are also being launched aimed at individuals. Individuals can assemble drones to obtain special scenes that cannot be obtained with existing cameras, and there are also increasing numbers of people enjoying hobbies as various conventions are held for individuals who assemble drones.

We implement an aviation shooting drone. Basically, it is designed to control sensor and motor using FC board and to receive the camera signal and display it on the screen. The signal from the transmitter is received at the receiver, transferred to the FC board, and sent to the parts from the FC board. We use a program called *Librepilot* to connect the FC board to the receiver controller. The images taken by the drone can be received through the 5.8GHz channel and transmitted through the FPV goggles, and the recorded images can be obtained through the separately installed action cams.

2. System Model

The system diagram of how the drones work is as shown in Fig. 1. We implement to control the drone using the FC board. We also attach the camera to the drones to obtain images at the drone point and transmit them to the monitor (goggles) through the 5.8GHz channel. After the FC board receives and processes the signal of the drones or the manipulator, it transmits the signal to the motor through the transmission. In order to maintain equilibrium during actual flight, the stability of the drones is improved by adjusting the sensor value through *LibrePilot*.

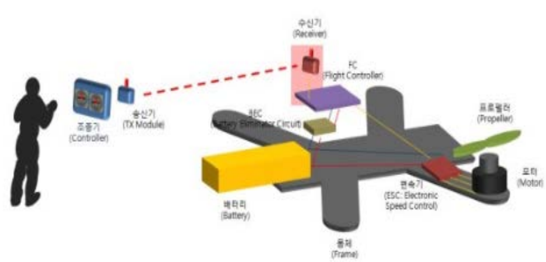

Fig. 1 The system diagram to show how the drones work.

We set up the design goals by purchasing the parts for the drone, making and blowing them. It is a big problem to be able to make drones that can shoot effectively with a given budget. As the performance of the craft increases, the size and the weight of the craft increase, so that the performance of the motor and the transmission must be increased. Due to the price of the parts, there are many restrictions on the economical point.

3. System Design and Implementation

Recently, drone related industries have attracted attention of many companies as an industry related to the fourth industrial revolution. Also, as the kid industry develops, the most prominent products are the drones. Basically, we make racing drone as a model. The picture taken using FPV camera is sent by the transmitter and sent through the monitor (goggles). Various sensors of the FC sensor are controlled by a program called *LibrePilot*. Also, the controller receives the signal through the receiver and gives it to the FC board for overall control of the drones.

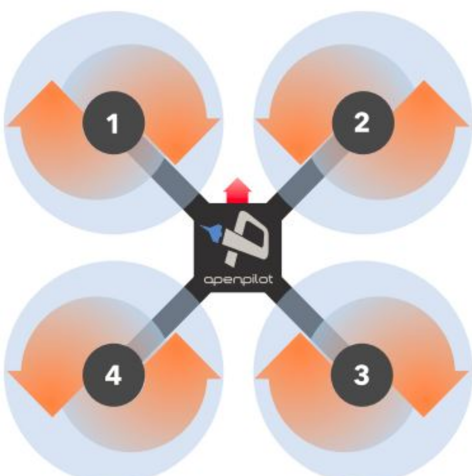

Fig. 2 Quad rotor using four motors to fly.

The drones that make up the work are quad rotors flying with four motors. The quad rotor rotates in the same direction with two pairs of diagonal propellers facing the propeller, and when the force acting on the fuselage against the direction of rotation of the propeller overcomes gravity and floats to the sky. The direction of flight is controlled by controlling the rotational speed of each motor.

As shown in the Fig. 2, when the front of the drones is looked up, the drones can fly when the motor 1 and 3 turn clockwise and the motors 2 and 4 rotate counterclockwise. Some motors are designed to match the direction of rotation, but products with a constant motor orientation can change the direction of the motor through the transmission settings. When all four motors are rotating at high speed, they rise from place. When they rotate at low speed, they descend in flight. When changing the moving direction of the drone, if the speed of the motor in the direction to proceed is decreased, the gas is inclined toward the speed decreasing direction and moved in that direction.

Since the voltage required by each part is different, it is set up so that the appropriate voltage can be supplied to each part through the voltage distribution board. The motors used in the production of the work were all products with the same direction, so it was necessary to operate them separately. The direction of the motor can be controlled through the transmission. There are two ways to adjust the speed of the transmission by directly changing the setting value of the transmission and by changing the direction of the motor and the connecting line.

If the signal from the transmitter is received by the receiver and delivered to the CC3D, the CC3D sends the signal to the transmission using this value and the sensor values to control the motor. The camera sends the image to the image transmitter of the captured image. The transmitter transmits the image to the monitor (goggle) by sending the image to the 5.8GHz channel. After completing the comprehensive design, verify that each element has the same output value as the original design. If you have a different output value than the first, examine each part to get the proper output.

Fig. 3 Frame used in our work.

When choosing a frame, three things are considered.

ISSN (Online) 2348 – 7968
www.ijiset.com

- The price should be cheap.
- Body and arm should be separated.
- FC and other components should be wide.

When the drones fall, the most damaged part is the arm part, so the integral type connected to the main body is likely to cause a lot of repair costs in a special situation.

The frame used in our work is ZMR250, which is a 250th grade frame, which is often used for racing. The size of the frame is measured by the distance between the center of the motor on one axis and the distance between the motor axes of the 250th class is 250mm. The typical shooting drones require a size of 500-700 or more because it is necessary to maintain stability against extraneous effects such as wind.

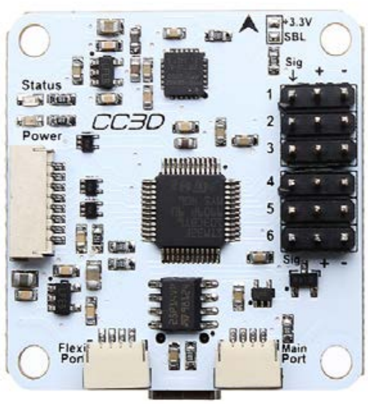

Fig. 4 CC3D board (one type of FC board) used in this work.

FC board is connected between the receiver of the radio remote control and the ESC transmission. The FC sends the motor control signal to the ESC according to the input of the control signal sent from the radio controller and the output value of the gyro sensor. Use the program *LibrePilot* to adjust the CC3D board values used in production. This program allows you to adjust the various settings required to fly the drone, such as setting the controller's channel, adjusting the PID value gain value, and setting the flight mode. CC3D does not basically provide air pressure sensor, geomagnetic sensor and GPS, so one can connect it selectively to improve the performance.

Connect the transmission, motor and propeller. We use the Little Bee 30A transmission, the XNOVA_RM2204-2300KV motor, and the 5045 propeller. When choosing a motor, we chose to use at least three times the total weight of the drones produced, taking into account the maximum thrust per motor per data sheet. If the total thrust value of the drones is less than that, overloading can occur during the drones. If overloading occurs, the flight time is shortened and the voltage drop may occur severely at take-off. For a basic drone, a 20A transmission is sufficient, but the performance of the motor that can be driven is limited, instead of low battery consumption. We will add more equipment to the drones, such as a camera, so we used a 30A transmission to get more motor performance.

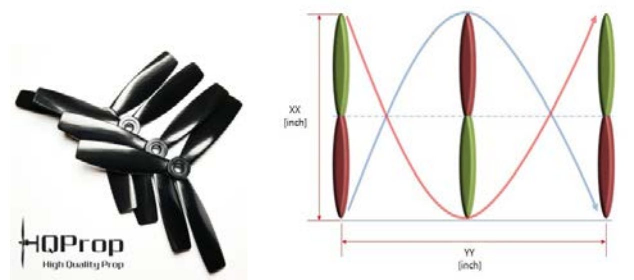

Fig. 5 Specification of propeller used in our work.

The standard of the propeller is XXYY, where XX is the total length of the propeller and YY is the pitch of the propeller, i.e., the length of the propeller when it turns a turn (see Fig. 5). A larger lift can be obtained, and the larger the YY size, the larger the advance distance even at a small rotation speed, so that the lift can be obtained more quickly. The motor used is provided with a thrust value in datasheets for 5030 and 5045 propellers, and the 5045 propeller is used to achieve higher performance just as the transmission is selected.

After connecting the spectrum satellite receiver and the FC board to receive the signal from the control unit, we connect the transmitter and the receiver using *LibrePilot*. This is called binding. In the case of drones for toys on the market, a channel is made to prevent signals from overlapping if the same instrument is in the vicinity, such as a manipulator. The connection between the controller and the gas is always maintained, which is called binding. The receiver used in the work transmits the signal in the DSMX method. Although the controller and receiver are more expensive than those using PWM and PPM, we chose the DSMX method for stable performance.

When an image is captured using FPV camera, the transmitter transmits this image to the 5.8GHz channel and receives it from the receiver. The 5.8GHz channel monitor receiver was not available for price reasons and replaced the receiver with a goggle for racing drone. The ordinary shooting drone is composed of FPV camera used for real

IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 1, January 2019
ISSN (Online) 2348 – 7968
www.ijiset.com

time video transmission and reception, and a high-resolution camera for video recording and high speed link transmission. In this work, the FPV camera is used to acquire the recorded image directly from the goggles.

4. Performance Test and Evaluation

The entire system was divided into two parts: the body of the drones and the control of the controller, the binding, and the sensor values using *LibrePilot*. In the first semester, we studied the function of each part of the drones and then made the drones. In the second semester, I purchased additional parts, set the values of each part using the *Libre Pilot*, and adjusted the actual values while flying.

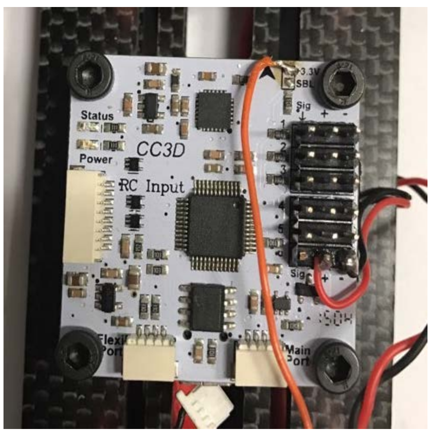

Fig. 6 Verification of CC3D connection between controller and transmission.

Fig. 7 Connecting 12V to all the frames.

We connect each frame and connect motor, transmission, and voltage distribution board. Where the motor and the transmission are soldered, they are wrapped with a retractor. We connect the transmission in clockwise order to 1,2,3,4 of the CC3D. Voltage connects the 5V voltage from the voltage distribution board. Then, we connect the transmitter receiver to the CC3D. Since the receiver used in the work is a DSMX type receiver, it cannot connect directly to the existing port of the CC3D, but connects to the Flexi port. Since the voltage needs 3.3V, disconnect the line and connect it to CC3D. We finally connect the video transmitter to the camera and supply 12V from the voltage distribution board, and then we connect the frame completely.

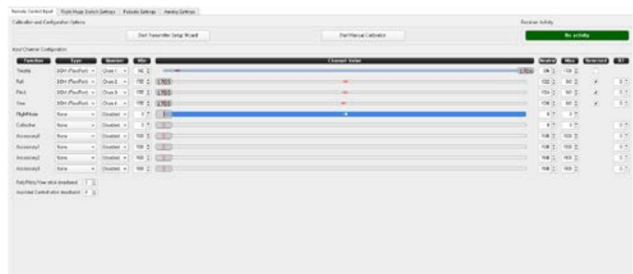

Fig. 8 S/W process to configure the controller.

Before connecting to the computer, proceed to bind the transmitter and receiver first. After connecting the CC3D board and computer with both the propeller and battery removed, upgrade the firmware on *LibrePilot*. Calibrate after adjusting the balance of the gas. Follow the instructions in the program to verify that each motor operates correctly after connecting the battery. At this time, it is necessary to check the voltage at which the motor moves first, and if it is not the same, it should be the same. Follow the instructions on the screen to set up the controller, complete the process and check Yaw, Pitch, and Roll Reverse.

After connecting the power to the drones, bind the controls to the receiver and control the drones. When flying indoors, there is a risk of a safety accident, so the operation of the drone is verified using a separate test device. You can confirm that the drones maintain a balanced state in the flying state.

4. Conclusions

In this paper, we presented an implementation of shooting drones. When evaluating the overall system, each part correctly transmitted the signal to the FC board, and on the FC board, each motor signaled the proper output. It was confirmed that the drones maintained the equilibrium well when actually flying, and it was confirmed that the equilibrium was maintained even when the balance of the gas collapsed due to external factors other than the signal of the manipulator. It was confirmed that the image taken by the camera is also received through the goggles. However, in order to maintain the altitude in order to obtain a stable picture when shooting, a skilled maneuver was needed. The FPV camera was able to acquire the image from the viewpoint of the drones, but the satisfactory image quality could not be obtained. In order to exhibit sufficient performance as a shooting drone, it was necessary to acquire an image through a camera other than the FPV camera.

If one look at the field of application as a work, one can check the terrain of the harder place and the geographical characteristic of the object because Bluetooth communication is not used. Depending on the performance of your camera, you may be able to identify situations in dangerous or restricted areas that people cannot reach. Using GPS and barometer sensors, it is likely that the drone will be able to control the flight altitude and secure a stable image. If we increase the size more than this, we will be able to maintain a stable flight condition even for external factors.

Acknowledgments

This study was supported by the Research Program funded by the Seoul National University of Science and Technology (2017-0819).

References

[1] C. Pfister, Getting Started with the Internet of Things, CA: O'Reilly Media, 2011.
[2] https://www.amazon.com
[3] *Drones Manual:* Purchase + Flying + Shooting + Production, Juniper, Adam.
[4] *Making Your Own Drone*: Personal Drone, Quad Copter, RC Boat DIY Production Manual, Bachital, John

Ye Hoon Lee received the Ph.D. degrees in electrical engineering from Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, in 2000. Since 2005, he has been with the Department of Electronic & IT Media Engineering, Seoul National University of Science and Technology, Seoul, Korea. His research interests include wireless communications emphasis on adaptive resource allocations and the baseband transceiver design in wireless channels.