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Quad-Copter (Pro-Q)

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Abstract*: The unmanned Vehicles especially aerial are of great use and improved exponentially in last decade after development in the fields of AI and computer vision.(PRO-Q) is a specially designed vehicle which has the capability of a advanced quadcopter which is powered by a very powerful controller raspberry pi 3B+ . The flight controller (CC3D) fulfills the duty of keeping the quadcopter stable and performs the complex maneuver by using the 3-axis gyroscope and 3-axis accelerometer. This paper deals with using two controllers on a single quadcopter one to control maneuver and other to be programmed to do other various tasks that is user specific. The quadcopter is designed so that we have a advanced UAV which is able to record video and those videos can be used in further applications like computer vision.

Keywords: AI , Computer vision and gyroscope.

I. INTRODUCTION

The development of small and efficient unmanned vehicles is under the interest and research of many scholars and also to traverse its applications in various fields of engineering. We can see a lot many projects and research topics under this domain from not only mechanical but also robotics and electronic streams. An initial report based on research has proven that the quadcopter is easy to make unmanned vehicle and if linked with various sensors and onboard computer it can be a very powerful instrument. It can be controlled in the simplest way by Bluetooth and other controlling mechanics can be as advanced as computer vision and image processing

II. CONSTRUCTION

It is a simple four-rotor arrangement in which the motors in opposite end rotates in the opposite direction to generate a net upward lift. It has a mainframe of light materials like HDPE or carbon fiber centrally connected four arms with a DC brushless motor attached to each end of the arm of motion of quadrotor. Rotors are attached to the shaft of each motor for aerial motion. An electronic speed controller is used with the DC motors for control over the speed of each motor via a flight controller.

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Electronic speed controllers are then connected with each other by parallel connection in the power distribution board powered by a battery.

III. THEORY

The quadcopter (PRO-Q) operates with 4 sets of motor and propellers. Now we have used a flight controller for controlling the motion of the motors. The other advanced mode of controlling the quadcopter (PRO-Q) can be visual detection another automation algorithms.
All DC brushless motor attached by parallel reference to other motors. Power distributed to power distribution board from battery. Further, the power distributes equally thus equal potential is provided at the input of each electronic speed controller and then goes into each motor. 3-axis Gyroscope and 3-axis Accelerometer will measure the angle of the quadcopter(PRO-Q) in terms of X, Y and Z axis and thus the flight controller accordingly adjusts the RPM of each motor so as to self – stabilize. The stability of quadcopter (PRO-Q) is achieved by the opposite direction of rotation of the motors directly facing each other. By using this we get the desired motion of the quadcopter (PRO-Q). RPM of the shaft of a motor is a function of voltage provided thereto motor. Roll and pitch can be controlled by changing the speed of the appropriate motor, while yaw control involves the proper balancing of all four motor results in to change at the moment and force applied to take an appropriate turn. Controlling of the quadcopter (PRO-Q) involves different three states. YAW, PITCH, and ROLL.

IV. WORKING

The input signal is generated and transmitted by using the Bluetooth In the laptop and received via using the HC05 module. The flight control module will decode the signal and control the amount of power given to the motor by the help of ESC(Electronic speed controller). The board also consists of a 3-axis gyroscope and a 3 – axis accelerometer to stabilize and balance the Quadcopter (PRO-Q).

Fig.1. Quad-copter view (1)

Directional movement can be achieved by decreasing the speed of the front motor and increasing that of the rear motor.

Fig.2. Quad-copter view (2)

Rotation can be achieved by reducing the voltage of the inner motor and that of increasing the voltage of the outer side motor.

The raspberry pi here comes in play as it is used to record the video by using the camera module and this video can be transmitted over the net or can be recorded. Later on various advanced algorithm like YOLO can be applied to it.

V. COMPONENTS

***Raspberry Pi*:** The Raspberry Pi contains a series of small single-board computers developed by U.K. Raspberry Pi 3 Model B contains a 1.2GHz 64-Bit quad-core processor, onboard 802.11n Wi-Fi, Bluetooth, and USB boot capabilities.

Fig.3. Raspberry Pi 3

Raspberry Pi Camera Board Module: It is a high-quality 5-megapixel image sensor which supports 640*480p90 video. The size of the module is 25mm*23mm*9mm and weighs over 9g [1]. The connection of the module to Raspberry pi is done via a short ribbon cable**.**

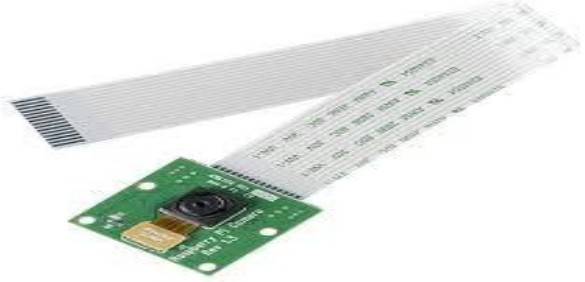


Fig.4. Raspberry Pi Camera Board Module

CC3D flight controller: This controller is 3-axis high-performance MEMs gyros and 3-axis high-performance MEMs accelerometer. Its size is 36mm*36mm and supports 4 layer PCB for superior electrical noise reduction and flight performance [2].

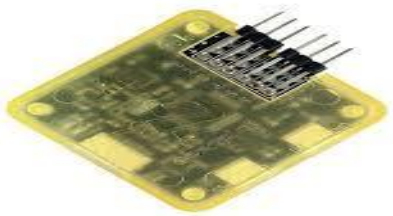


Fig.5. CC3D flight controller

Propellers and Motors: Propeller converts rotary motion from the power source into slipstream which pushes the propeller forwards and backward [3]. Whereas the motors are DC's having advantage of high power to weight ratio, high speed, and low maintenance [4].

Li-Po battery: It stands for lithium polymer battery and is a type of rechargeable battery that has taken the electric RC world by storm, especially for planes, helicopters, and multi-rotor/drone. The main advantage is that it is lightweight and can be made in any shape and size [5].

Fig.6. Li-Po Battery

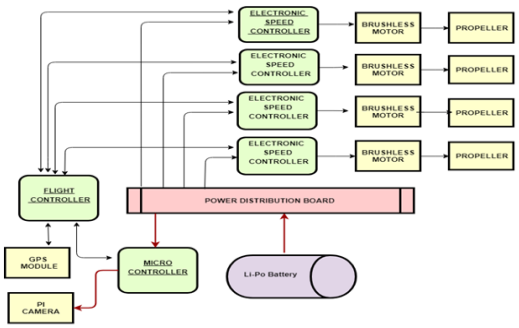
GPS module: GPS that is a global positioning system is a satellite-based system that uses satellites and ground stations to compute its position on earth [6]. This GPS module is used in many applications like smartphones, Cabs, Fleet management, etc.

Fig.7. GPS Module

Hc-05 Bluetooth Module: This module is used for Raspberry Pi and other micro-controller too. Operating voltage and current are 5 V and 30 mA respectively. The technique used by this module is Frequency-Hopping Spread spectrum (FHSS) and follows IEEE standard.

VI.PROPOSED METHODOLOGY

1. Block Diagram / Flow Chart

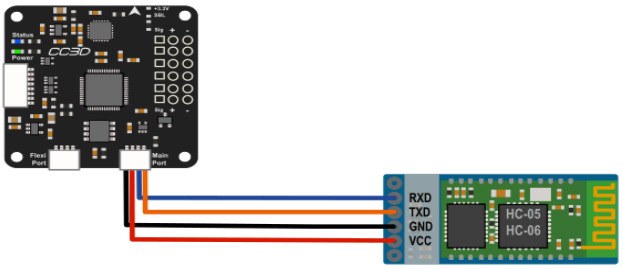


The connections are made as shown in Block diagram. Firstly the Power Distribution Board is connected to all the Electronic Speed Controller (ESC) which further gets connected to Brushless motors and Propellers. Now the ESC's are connected to Flight Controller, Micro-controller and Li-Po Battery. Pi Camera is controlled by Micro-controller.

2. Algorithm To Setup Bluetooth Telemetry

We use a HC-05 module with cc3d to setup a telemetry connection. This steps were follow to configure HC-05.

- Connect the wires according to the diagram.
- Connect USB cable to the flight controller.
- Set the following settings:
- USB VCP Function ComBridge
- Main Port ComBridge
- Speed **9600**
- Click **Save**, and wait a few seconds for the changes to apply.
- Reboot the flight controller,



Now we will configure the Baud rate following these steps

- Firstly download (Bluetooth configuration software by PT_Dreamer) .
- Secondly extract the files and launch the configuration program by clicking on the .exe file.
- Thirdly select **COM port** and baud **9600**, and finally click **connect**.
- Now, Select the appropriate **Speed** (i.e Baud Rate 38400 or 57600), **name** and **pin** code.
- Lastly, Click **Write values**.
- Configuration is done.

After following these steps Bluetooth module is configured and can be used for telemetry connection.

VII. RESULT

- Quad-copter is flying successfully.
- Telemetry connection was successful.
- Flight time 20 minutes was achieved.
- The media from camera was successfully recorded and shared.
- Quad-copter can be used for surveillance and various other application such as crowd management military or monitoring frost conditions in the farmlands, Object identification

VIII. CONCLUSION

The innumerable advantages of Quadcopter lead to their growth in a short span of time. They have a few disadvantages but those can be rectified. Today most Quadcopter are controlled by either softwares or other computer programs. The components of a drone are based on what type of work needs to be done. Batteries, ESC's all come in different ranges according to the type of work needed to be done by the quadcopter. Quadcopters are the highly provisional craft that could get in between airplanes and helicopters and are hence easier to fly all the time. Beside 3Dflight controller, such as inverted flight controller, quadcopters give a more acrobatic feel to its flyers. Quadcopters offers a huge balance between cost , capability, and performance. The only problem is when funds are coupled with highly ambitious projects. A solution for this could be to gradually improvise on inventing quadcopters with new enhancements and new designs. Hence quadcopters have an exemplarily bright future.

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