Quadcopter is one type of multi-rotor. The main objective of making it is for aerial photography, and surveillance. It basically operates on Newton’s third law or Bernoulli’s principle. The application of it is not limited to one or two but it could be extended to many. APM 2.6 is a pro-quality IMU autopilot based on the Arduino Mega platform, which can turn any RC vehicle into a fully autonomous Unmanned Aerial (or Ground) Vehicle.

Keywords: RC Quadcopter, RC Multirotor.

1. Introduction

Quadcopters are emerging as a popular platform for unmanned aerial vehicle (UAV) research due to simplicity of their construction, maintenance and durability to hover and their vertical takeoff and landing (VTOL) capability. This vehicle can do the task of aerial surveillance, search and rescue, payload transportation, aerial photography etc. Many colleges are spending enormous resources to develop better and better of this vehicles.

2. Body

Fig (a). Body of the Quadcopter.
3. Principle

A) Elevation (up/down)

Newton’s third law of motion i.e. “For every action, there is an equal and opposite reaction”.

B) Forward/Backward

This is also done by newton’s third law of motion by varying rpm of four motors. This moves the quadcopter forward and backward.

C) Roll (Left/Right)

This control moves the quadcopter left and right according to the user input.

D) Left/Right 360˚ rotation

If a motor is rotating propeller in clockwise direction it is being altered by a counter torque in anticlockwise direction and vice versa.

E) Hover

One pair of opposite facing propeller rotating clockwise (cw) direction and one pair of opposite facing propeller rotating anti cw direction thus net torque as zero under constant current supply.
4. Transmitter Control

![Diagram of the transmitter and control settings]

**Fig (e). The transmitter.**

![Diagram of quadcopter movement]

**Fig (f). Movement of the Quad.**

**Main controls:**

Roll
Pitch
Yaw
Throttle

**ROLL:**

Roll moves your quadcopter left or right. It’s completed by shoving the right stick on your remote to the left or to the right. It’s called “roll” because it literally rolls the quadcopter. For example, as you drive the right stick to the right, the quadcopter will slant diagonally downwards to the right.

![Diagram of aileron movement]

**Fig (g). Rear view.**
Here, the bottom of the propellers will be facing to the left. This drives air to the left, forcing the quadcopter to fly to the right. The same thing happens when you push the stick left, except now the propellers will be pushing air to the right, forcing the copter to fly to the left.

**PITCH:**

Pitch is completed by shoving the right stick on your transmitter forwards or backwards. This will tilt the quadcopter, emerging in forwards or backwards movement.

![Fig (h). Left side view.](image)

**YAW:** Yaw is a slight bit mystifying in the beginning. Essentially, it rotates the quadcopter clockwise anti clockwise. This is completed by shoving the left stick to the left or to the right. Yaw is normally utilized at the alike period as throttle across constant flight. This permits the pilot to make circles and patterns. It additionally permits videographers and photographers to pursue objects that could be changing directions.

**Throttle:** Throttle provides the propellers on your quadcopter plenty of thrust to get airborne. After hovering, you will have the throttle involved constantly. To involve the throttle, drive the left stick forwards. To slow down, pull it backwards. Make sure not to pull it completely till you’re a couple inches away from the ground. Otherwise, you could damage the quadcopter. Note: When the copter is facing towards you, all the controls become opposite. Left becomes right and vice versa.

### 5. Main Components

- The frame
- Motors
- Electronic Speed Controllers (ESC)
- Flight Control Board (APM 2.6)
- Transmitter and Receiver
- Propellers
- Battery and Charger
- GPS mount

The construction links all of the supplementary components. For a quadcopter, it’s shaped in whichever an X or a + shape. If you’re constructing your own quadcopter, you desire to ponder the size and heaviness of the construction and
how it will alter your hovering experience. The motors rotate the propellers. A quadcopter needs four motors, because one motor powers a solitary propeller. The higher the Kilovolt, the faster the motor will spin. “Kilovolt” is frequently quoted in RPM each volt, that way that a 1000 Kv motor on a 10V supply will rotate just below 10,000 rpm at no load.

**Electric Speed Controls (ESCs)** are wired constituents that link the motors and the battery. They relay a gesture to the motors that tells them how fast to spin. At each one period, every single of your motors might be rotating at disparate speeds. This is what lets you maneuver and change direction. It’s all led by the Electronic Speed Controls, so they’re extremely important.

**The Flight control Board** is the “chief of the activities”. It governs the accelerometer and gyroscopes, which manipulates how fast every single motor spins. This flight controller is based on the rapidly evolving and refined Ardupilot mega or “APM”, an open source project from 3DR robotics. This amazing flight controller allows the user to turn any fixed wing, rotary wing, or multi-rotor vehicle (even boats and cars) into a fully autonomous vehicle, capable of performing a wide range of tasks even programmed GPS missions with waypoints (with the optional GPS module). It is a full autopilot capable of autonomous stabilization, way-point based navigation and two way telemetry with radio telemetry modules. It Supports 8 RC channels with 4 serial ports. Wireless transmitter is your remote domination, and the receiver is the antenna on the copter that listens to the remote control. After you make an adjustment on the transmitter, the receiver is what understands that command and sends it to the rest of the system. A quadcopter has four propellers, and every single one helps ascertain the direction the quadcopter flies or whether it hovers in place. The battery is the base for the finished quadcopter. This needs to be charged and recharged, because lacking a battery, you cannot hover your quadcopter. The charger replenishes your battery so you can use it for several flights. The GPS mount records and keeps a track of the quad while it is hovering. And it is very useful when there is signal loss. It then bring back the Quad to it home position by a flick of a switch.

![Fig (i). Map showing GPS track.](image-url)
6. Mechanical Point of View Work Done

A. Design
B. Pitch balancing and calculation
C. Thrust calculation
D. Roll balancing and calculation
E. Yaw balancing and calculation
F. Elevator balancing and calculation
G. Dynamic balancing
H. Static balancing
I. Center of gravity localization
J. Various machining,
K. Airflow adjustment

7. Scope/Applications

A. Aerial photography/Videography for geological information
B. Military surveillance
C. Payload transportation
D. Spying
E. Search and rescue
F. As self-destruction drone to destroy enemy.

8. Technical Data

- Thrust of single motor at full throttle with 10*4.5 propeller = 1.045 kg approx.
- Total upward thrust of quadcopter = 4 kg approx.
- Weight of quadcopter = 700 gm approx. (Without Battery)
- Net upward thrust at full throttle= 3.54 kg approx.

9. Why better than other UAVs like helicopter, airplane?

A. Enhanced stability
B. Cheap unmanned aerial vehicle  
C. More payload capacity  
D. Easy construction  
E. Low maintenance  
F. No complex controlling mechanism  
G. Provision of great stable FPV(first person view) platform  
H. Vertical Take-off and landing(VTOL)  
I. Eco friendly  

10. Conclusion  
This aerial vehicle has a wide range of application. In case it is used in police and military force then life and money can be saved. It also proves to very cheap platform for aerial photography if HD camera is installed as payload. Its source of energy is electric current and hence it doesn’t pollute. 

11. Current Work-Progress Currently it is able to fly as per its movability. It is able to take pay load of around 1 kg. In future GPS function with return to launch function will be installed so that whenever the Quadcopter goes out of range it returns to the place where it launched automatically. 

12. References  
1. http://www.google.co.in  
2. http://www.youtube.co.in  