Quadcopter : An Unmanned Aerial Vehicle

Moitry Samanta[1], Apaar Mishra[2], Hitesh Sawlani[3], Khemant Gupta[4]

Abstract—Research interests in Quadcopters have increased, as the sensors and control systems are getting more advanced. There are many commercially available Quadcopters for sale. Our design is application specific with limited resource available, it was largely decide to restrict the application for wireless control and camera transmission based on Battery Power, hardware weight including the motors, wireless modules and controller. This is the preferred platform used and it has high performance characteristics. The Quadcopter requires an extensive control system in order to fly. Building a Quadcopter for an educational purpose, and to discover and resolve its complexity is an experimental project which can be further improved as application and enhancement point of view.

Keywords-Rotors, Takeoff, Hover, LipoBattery, Yaw, Pitch, Roll

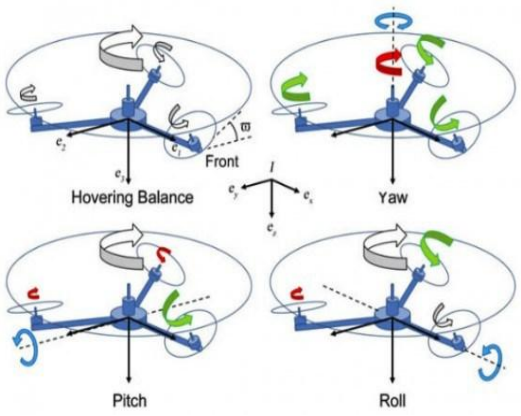
I. INTRODUCTION

Humans are fascinated by levitation. The reason is probably that the world we are living in is three-dimensional. However, human beings live and move mainly in two dimensions. It seems that humans have a very strong drive to overcome their biological limits. This leads to build machines that enable them to move in three-dimensional space, e.g., airplanes and helicopters. No matter how complicated the geographical feature is, it doesn't become a trouble if it flies in the air. What's more, it is possible to use it even in a considerably severe region. And it can be controlled remotely to carry out a wide range of investigations. Unmanned Aerial Vehicles (UAVs) are crafts capable of flight without an onboard pilot. They can be controlled remotely by an operator or can be controlled autonomously via pre-programmed flight paths.

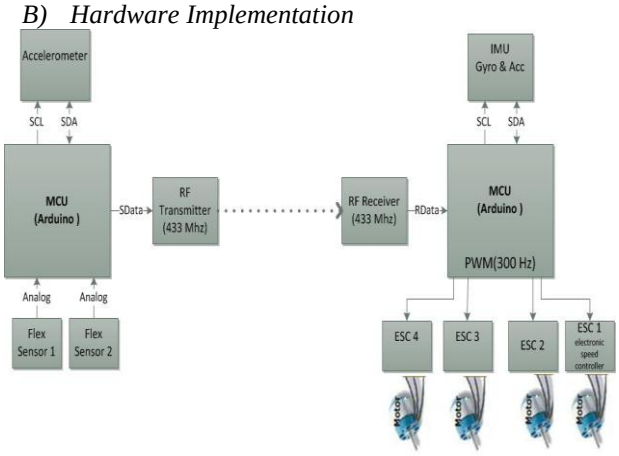
A quad-rotor helicopter (i.e. QUADCOPTER) is an aircraft whose lift is generated by four rotors. Control of such a craft is accomplished by varying the speeds of the four motors relative to each other. Quad-rotor crafts naturally demand a sophisticated control system in order to allow for balanced flight. Uncontrolled flight of a quad-rotor would be virtually impossible by one operator, as the dynamics of such a system demand constant adjustment of four motors simultaneously. The goal of our project is to design and construct a Spycopter, quad-copter capable of Indoor-outdoor flight and hover with an onboard wireless camera used for remote surveillance and control. Through the use of an integrated control system, this vehicle would be capable of autonomous operation, including take-off, hover, and landing capabilities, controlled remotely by an operator and let the view the real-time footage captured by the camera.

Circuit Diagram

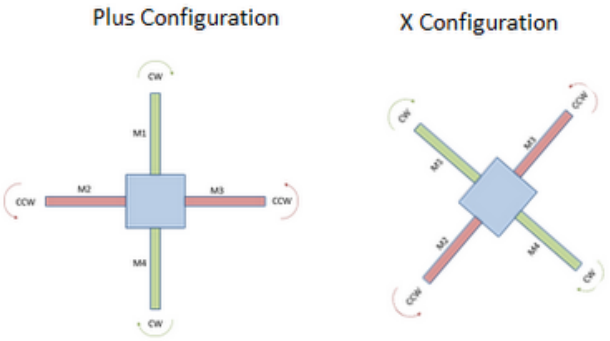
A) Tricopter Configuration



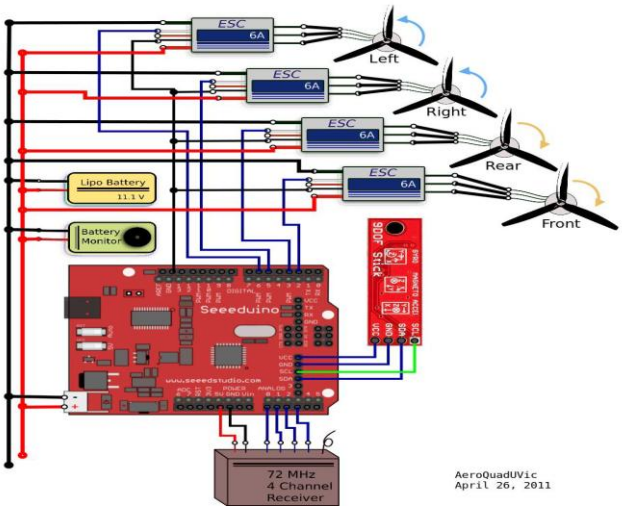
B) Hardware Implementation



C) *Quacopter Configuration*



D) Controlling Electronics



Components Used-

- Frame: a motor to motor distance of around 60 cm ~ 24″, though it will be possible to make it less.
- Propellers:
  The diameter of the propeller indicates how much air the propeller will be able to "move" while the pitch indicates how much air the propeller moves all the time – not said that you can use this in any way to calculate the air moved. The larger diameter and pitch the more through the propeller can provide. But be-aware that a large pitch makes it much harder for the motor to drive it, it requires much more power, but in the end it will be able to lift more weight.
- Brushless DC electric motor: (**BLDC motors**, **BL motors**) also known as **electronically commutated motors** (ECMs, EC motors) are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. In this context, AC, alternating current, does not imply a sinusoidal waveform, but rather a bi-directional current with no restriction on waveform. Additional sensors and electronics control the inverter output amplitude and waveform (and therefore percent of DC bus usage/ efficiency) and frequency (i.e. rotor speed).

- ESC – Electronic Speed Controller:
  As the brushless motors are multi-phased, normally 3 phases, you can't just apply power to it to make it spin. The motors requires some special phase-control electronics that is capable of generating three high frequency signals with different but controllable phases, but the electronics should also be able to source a lot of current as the motors can be very "power-hungry".

APPLICATIONS:

- Due to small size and maneuverability they can be used in application in remote and desolate regions, where they can be used to detect life forms, minerals, water levels, radiation, etc.
- Quadcopter can be used as unmanned aerial vehicles for surveillance and reconnaissance by military and law enforcement agencies, as well as search and rescue missions in urban environments.
- The largest use of quadcopters has been in the field of aerial Imagery. Capturing aerial imagery with a quadcopter is as simple as programming GPS coordinates and hitting the go button. Using On-board cameras, users have the option of being streamed live to the ground. Many companies have used this for real estate Photography to industrial systems inspection.

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