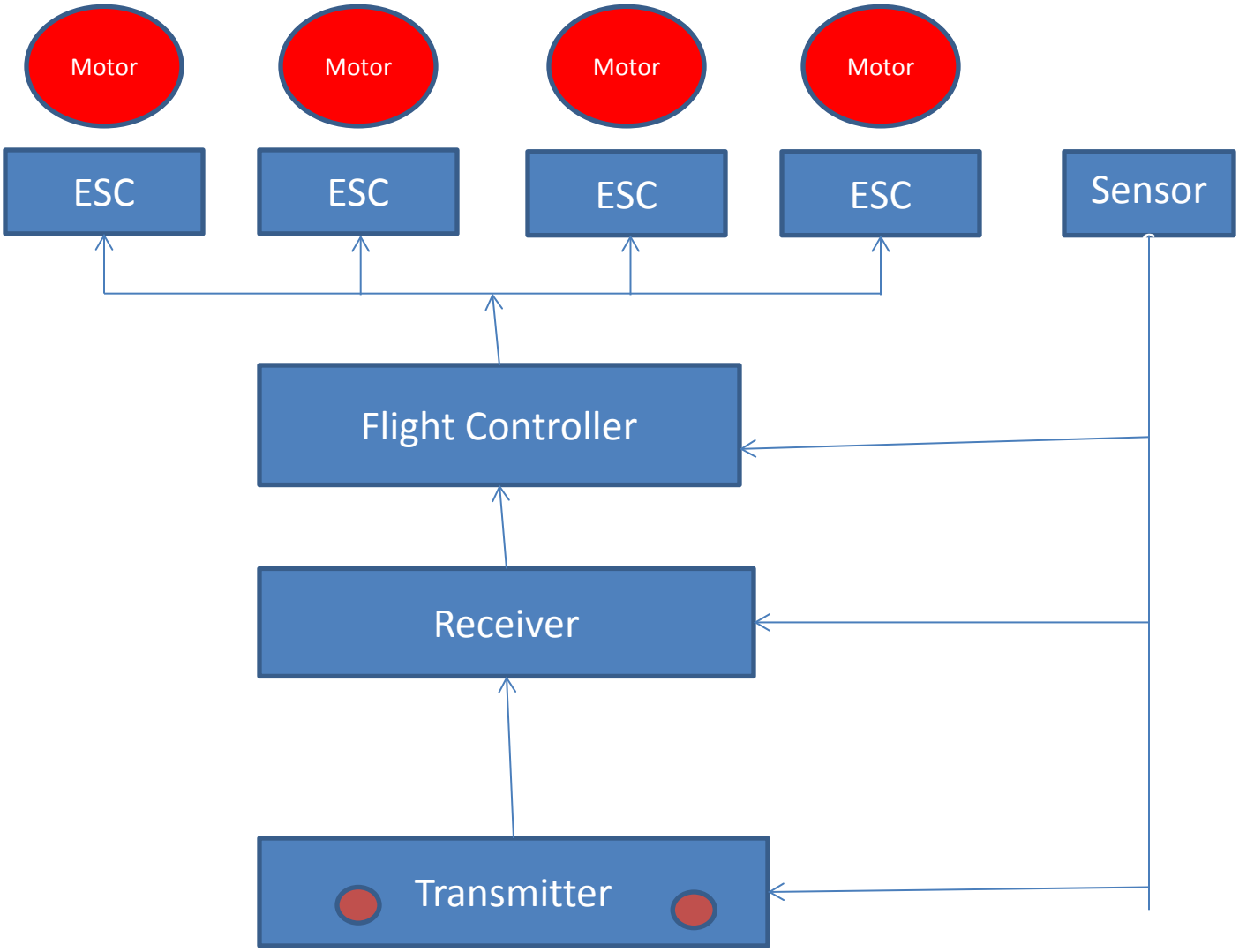
Control Systems for Quadcopter



Main Components of Control System

Brushless DC Motors

Are actually three phase AC motors.

ESC (Electronic Speed control)

Converts the DC from the battery into three phase pulses to drive the motor. There are multiple options for the input to the ESC, the most common being pulses of varying width every 20 ms. The width of the pulses varies to control the speed centered around 1.5 ms.

Transmitter

Now we know what we have to control we will examine how we do this manually using the controls on the transmitter.

Roll – Done by pushing the right stick to the left or right. Literally rolls the quadcopter, which maneuvers the quadcopter left or right.

Pitch – Done by pushing the right stick forwards or backwards. Tilts the quadcopter, which maneuvers the quadcopter forwards or backwards.

Yaw – Done by pushing the left stick to the left or to the right. Rotates the quadcopter left or right. Points the front of the copter different directions and helps with changing directions while flying.

Throttle – To increase, push the left stick forwards. To decrease, pull the left stick backwards. This adjusts the altitude, or height, of the quadcopter.

How it is done

Many transmitters operate in the 2.4Ghz band using FHSS (frequency hopping spread spectrum).

Data from the controls is digitized and sent as a packet. Error control is sometimes used. There seems to be many protocols.

Receiver

The receiver converts the data from the transmitter to a form acceptable to the flight controller. Again, there are multiple protocol options.

Flight Controller

The Flight Controller uses the information from the Transmitter and any additional sensors (barometer, accelerometer, gyro, compass, GPS, etc.) to control the drone. Control is achieved by individually controlling the speed of the motors.

Our system

Although we could insert control at multiple points in the chain, as shown in the diagram, the most promising is the Flight Controller. Rather than starting from scratch, an open source approach seems the most promising.

I have found the most information on *Ardupilot*. It runs on multiple platforms:
http://ardupilot.org/copter/docs/common-autopilots.html

My initial preference is for the BeagleBone Blue. It is well documented and available from multiple distributers: https://beagleboard.org/blue