Quadcopter-Engineering Journal

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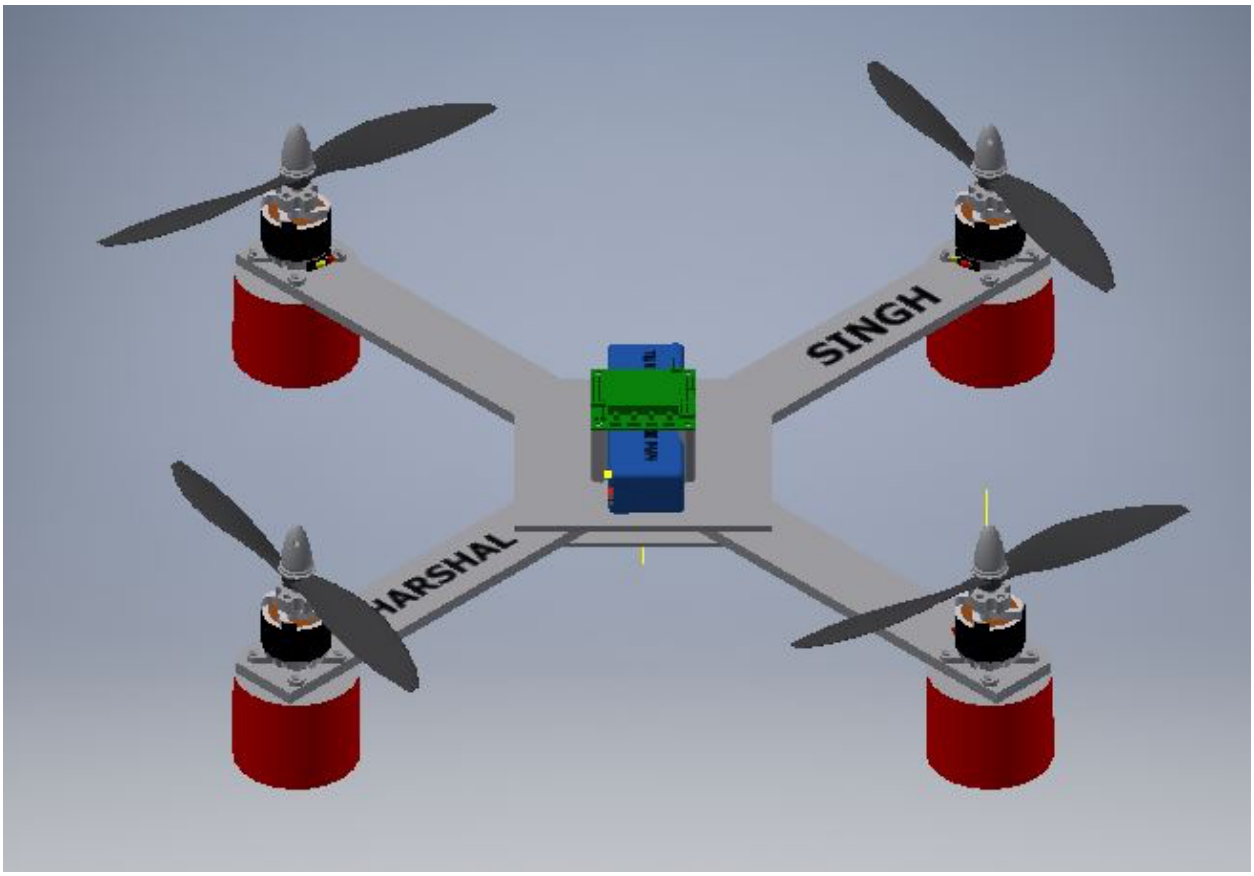

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I decided to build a Quadcopter in the summer of 2015. I had stumbled upon videos of breathtaking aerial photography and intense quadcopter racing. I wanted to build my own machine that could fly in air. I knew it was emerging technology that had huge potential for innovation, and I wanted to be on the forefront of that.

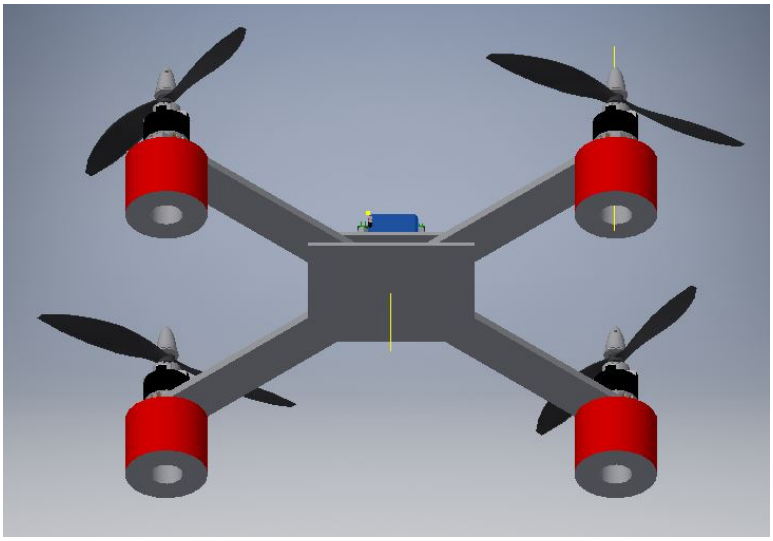
Planning

I started out with a rough sketch of how I wanted my Quadcopter to look. I decided to go with an X-shaped form factor, to ensure a balance between stability and surface area to mount more features on the drone. My goal was to keep things inside a 15 inch square, for easy transportation.

Picking out the right mechanical parts involved a lot of research. I had to make sure the battery-speed controller-brushless motor combination was well powered, and that the motor speed would suit the propeller form factor to get enough lift. To control the drone, I picked a flight controller that could be completely customized. I went with the KK 2.1.1 chip, as I could flash new firmware onto it at any time.

Before building it, I designed the whole system virtually, using Autodesk Inventor (Computer Aided Design) software. This helped me map out the frame, and cut my parts to the perfect size. While designing it, I held an emphasis on having a modular system.

My drone is designed to have sections that can swap out with different functional components. I called these "modules", and each module was designed to work with the frame. I did this to make sure my drone would never fall behind the technology, and it could always add new components (like cameras and GPS) without a major redesign. The Gallery has examples of these modules.



Iterations

Version 1- Version 1 of the Drone was a story of bad crashes and going back to the drawing board. I did not have a grasp of the controls, and my drone did not have the features necessary for a first time flyer to be safe. I kept these in mind as I worked on Version 2.

With Version 2, I added hardware features to ease flight. I added colored propellers and tape to differentiate between the front and back of the drone, something that was hard to do mid-flight. I also added shock absorbent pool noodles to the bottom of the drone. This reduced the number of major crashes.

In Version 3, I focused on the software. Because my drone had a unique weight distribution, I had to alter the PID algorithm self-balancing system so it would not be too aggressive. I also made sure the drone was more responsive to human controls, and could deal with wind better. Eventually, I flashed custom firmware to the board. This would be exactly how I wanted it to be, and I made controlling the drone a breeze.

I focused on increasing the drone's functionality through modules in Version 4. I added a servo motor that could hook on and release small bags in flight. I used this to deliver food to a neighbor. I also added First Person View functionality. This involves a small camera mounted on the frame that can live stream a video feed to goggles I made. By doing this, I can fly the drone while looking at the view from the drone's cockpit.

Planned Future Additions:

- Folding frame
- GPS auto flight
- Vision sensors for on board flight tracking of obstacles
- Make it more aesthetically pleasing

Gallery

Flying the drone

An aerial image taken of a local neighborhood

During an outreach event, to get kids excited about STEM, we took this picture.

A close up picture of my quadcopter

This is my FPV module. The wood secures it to the frame, and allows for quick swapping of different modules. This particular one has a small camera and a motor to shift viewpoints.