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Self-Stabilizing Gimbal

for recordings in rocking boats

Introduction

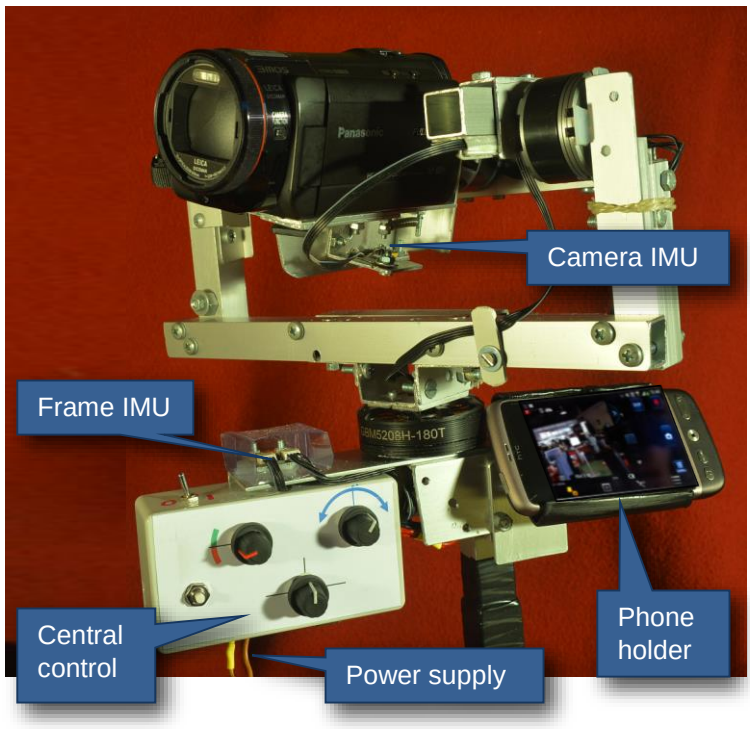
When I lived in Rauma some years ago, I enjoyed sailing with my small boat in the archipelago and made some long trips which I documented on video. When I mounted my camera on my boat, I found it very unsatisfying that on the resulting video the boat stands still while the horizon is moving and rocking. The viewer gets seasick because he sees exactly the opposite of the reality.

On Youtube there are tons of those videos from cameras mounted in boats. But how can a camera get stabilized? The well-known Steadicam system was the wrong way, I thought of something which aligns itself quite alone for an unlimited time. After several failures I found the solution.

Technology

I found that the same problems are also connected to quadrocopters where lately a strong development has taken place. Quadrocopters can not be controlled purely manually, they need a sophisticated control system with electronic position and movement sensors – and the same components are also used to stabilize cameras which are carried by quadrocopters.

This technology is also used in hand-held gimbals which are going to replace the merely mechanical Steadicam systems. But obviously no one had yet the idea to use them in a rocking boat. It seems that quadro–copter builders and sailors are living on quite different planets. This project wants to build a connecting bridge.



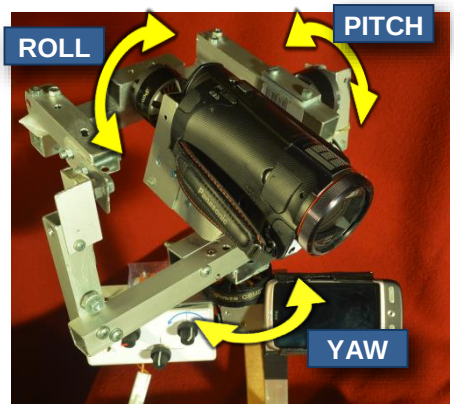
Expensive Purchasable Gimbals

Those available hand-held gimbals are very expensive. For proper working, the center of gravity of the camera and all parts has to be located at the intersection of all motor axes. Therefore, purchasable gimbals have variable elements which can be adjusted to the camera, but this feature increases the price of those gimbals.

My Cheap Gimbal

My device is tailor-made for my camera. I ordered three brushless motors and a control board from quadrocopter web shops and built a cheap gimbal out of simple aluminum profiles. It has no hand-held grips, but can easily plugged onto another aluminum profile which might be fixed somewhere to a boat. In order to reduce weight, a power supply with some accumulators is placed in an additional box which can be carried on a shoulder strap.

The gimbal has two IMUs (inertial measurement units = sensors for velocity, gravity, orientation) which are connected to the central control board. One of them is placed under the camera, the other one is placed on the bottom frame. Three controls can give extra adjustments to the camera in all three axes. So I can pre-set the direction of the camera which is then maintained by the gimbal.



Remote Control for ”Selfies”

I am using a Panasonic camera which is able to set up a Wi-Fi network and establish a connection with a mobile phone. The Panasonic “Image App” turns the mobile phone into a remote control for the camera. The viewfinder image is shown on the screen, and zoom and other functions can be controlled. Therefore, I equipped my gimbal with a mobile phone holder.

As a remote control for the gimbal, I built a second control box with a 5 m long cable which replaces the above mentioned controls automatically when the cable is connected. Also this remote control box has a mobile phone holder. So I can place the gimbal somewhere in my boat up to 5 m away from the place where I am sitting, and I can control the gimbal as well as the camera while the camera records pictures of me.

”Follow” Mode

The control board can store up to five different settings. By pressing a button on the gimbal control box or on the remote control box, I can select one of the settings with different ways of behavior of the gimbal. For example, I can choose whether the gimbal shall work fast (but perhaps with overreactions) or reliable but slow. And I can switch the Follow Mode on and off. In Normal Mode, the gimbal keeps the camera always in the same direction regardless how the support moves or turns. This means, if I sail north and turn west, the camera keeps pointing to the north. In Follow Mode, the gimbal compensates fast and small movements, but follows slow and big turns. In this case, the rocking of the boat by the waves is compensated, but if I turn the sailing direction, the camera will also turn to the new direction. Of course this applies only to the yaw axis; the Follow Mode is not recommended for the pitch axis and must be switched off for the roll axis.

Benefits for All

This project archives benefits for all. Sailors get acquainted with a yet little known way how to make much better and more realistic videos than before. This will lead to an increased demand and sales of special parts (controllers, motors, etc.) and hence to lower prices, which will be a benefit also for quadrocopter builders.