Autonomous Flight With the Ar Drone© drone

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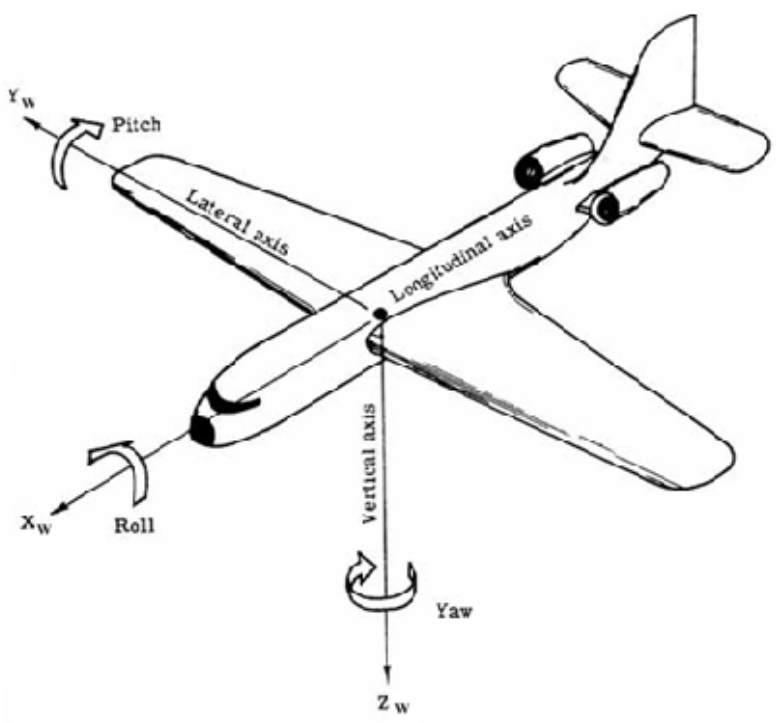
The Ar Drone©

The Ar Drone© is an over WiFi remote controlled quadrocopter that has several onboard sensors:

- One vertical camera, pointing downwards
- One horizontal camera, pointing forward
- Ultrasound altimeter, to measure the altitude
- 3 axis accelerometer (measures propellor acceleration)
- 2 axis gyrometer
- 1 yaw precision gyrometer

Furthermore, it has an onboard computer system running Linux.

Movement Angles



Our Goal

Summer-IMAV 2011 Indoor competition, some sub-tasks of the exploration challenge:

- Pick-up Object
- Exit Building
- Release Object

Controlling The Drone

- Direct Control
  - Sending AT-Commands to ports
  - Listening on different ports to decode navigation data and video
- SDK, the Software Development Kit
  - A complete framework that takes care of decoding and encoding
  - Over complicated
  - Othermans work
- Extending C with Python
  - We are better at Python
  - Python is less complicated

Finding The Object

To find the object the drone complete a search pattern

- Go to altitude X
- Rotate 360 degrees
- If the object has not been found, increase altitude X and repeat

Recognizing The Object

- Convert video frame to HSV
- Discard pixels that do not match the color of the object
- Template match to find the middle of the object
- Calculate the distance by calculating the amount of recognized pixels

Pick Up The Object

- Get the object in the middle of the screen
- Fly towards the object
- Hover in front of the object at a distance of 0.5 metres
- Fly above the object to pick it up

We send variable steering commands to the Ar Drone© , depending on the distance of the object and its location in the image to first radically steer in the right direction and then presicely center the object.

Problems

- Flying errors
- Object weight
- Pick-up method

Unsuccesful Explored Options

- Detect unwanted movements and steer against those
- Flat-trim at the start of each run

Solutions

- A floor with texture; put random things on the floor
- Restart when the flying error is too big
- Bigger object and hook

Results

We can show you a replay and a movie of a succesful pick up.

Future Work

While the Ar Drone© can not pick up the object succesfully at every run, there is still hope.

- A different pick-up method, magnets or velcro
- A smaller object with less weight
- Something to keep the object from being blown away by the wind (tape?)
- Constant altitude when flying over objects
- Small adjustments to the code to exit the building