



Autonomous drone for competition

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Summer Drone Competition



A summary of the competition has been posted on the lab website.

Goal: Through years of technical accumulation, achieve the goal of rapid autonomous execution .

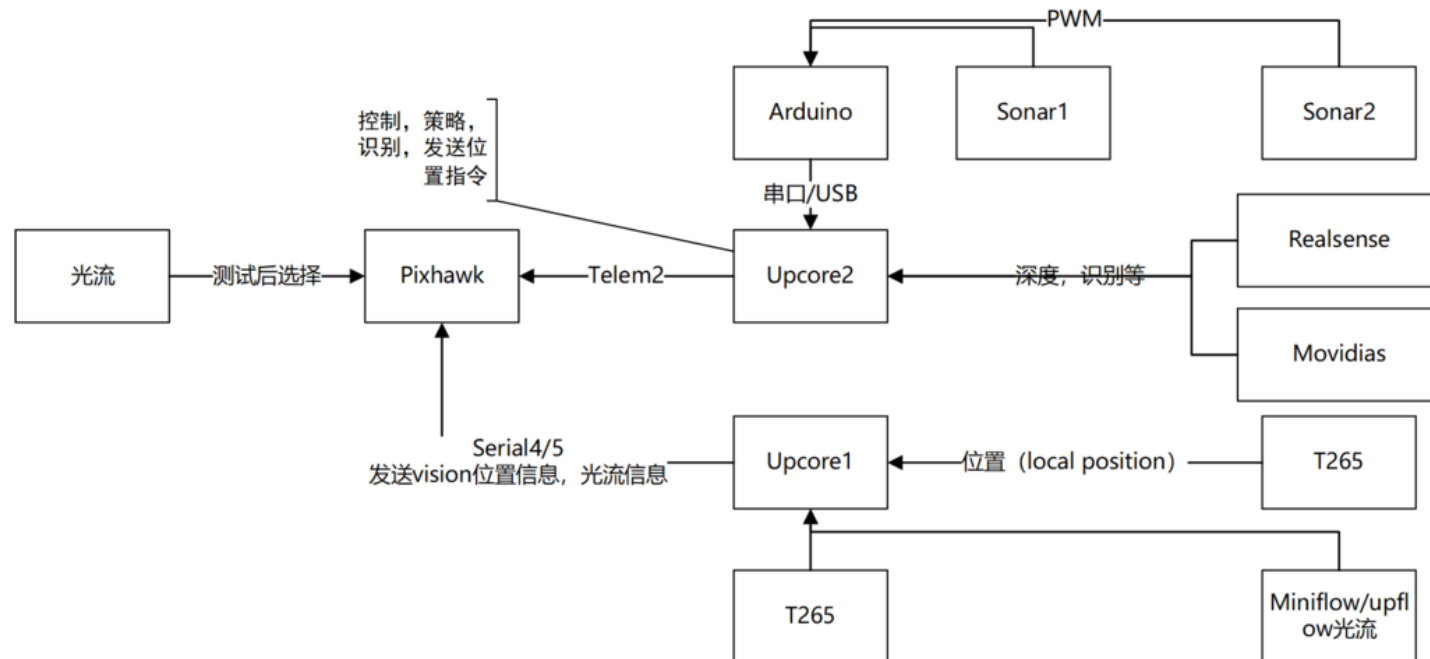
Content of the game :



What to focus on next year



- Stable platform (Attention when assembling the aircraft: center of gravity, electromagnetic shielding)
- Research competition rules
- T265 damping 、 Use better hardware (USB hub)



Share some links



- <http://dev.px4.io/master/en/index.html> Developer Guide (Quick Start)
- <https://discuss.px4.io/> (PX4 forum)
- <https://github.com/PX4/Firmware> (PX4 code)
- <https://github.com/PX4/Firmware/issues> PX4 issues
- <https://github.com/PX4/Firmware/pulls> PX4 PR
- http://dev.px4.io/master/en/advanced/parameter_reference.html (parameter_reference)
- <https://github.com/Plasmatree/PID-Analyzer> (After the flight log is uploaded, The joystick response in flight is converted into a step response. It is easy to tune PID , and many interesting functions.)
- <http://shequ.dimianzhan.com/>

Share some links



- <https://www.flyeval.com/>
- <https://github.com/generalized-intelligence/GAAS>
- <https://gaas.gitbook.io>
- Content that you can watch slowly :
- <https://www.youtube.com/user/PX4Autopilot> Developer Conference Video

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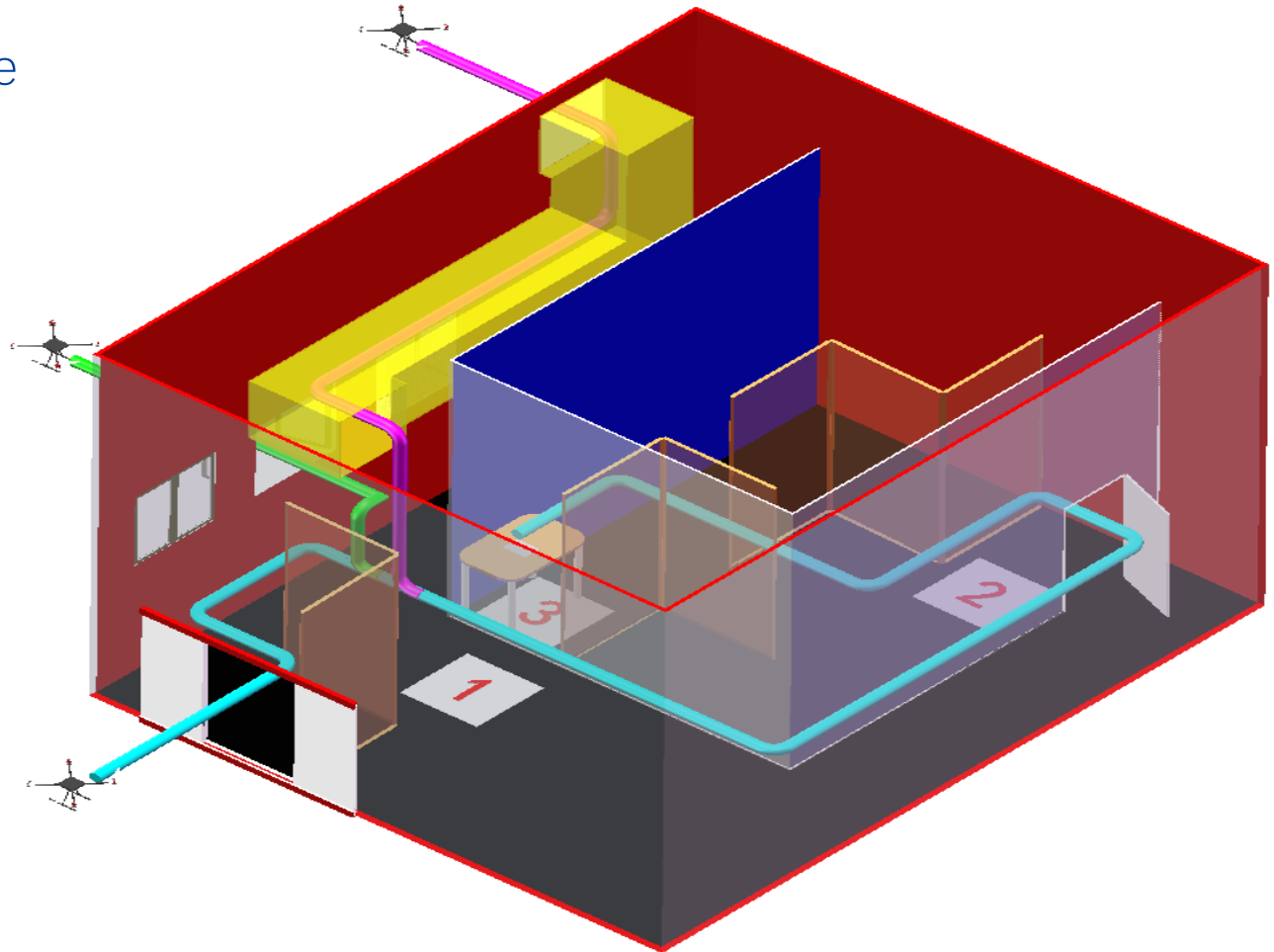




Intelligent MAV Competition



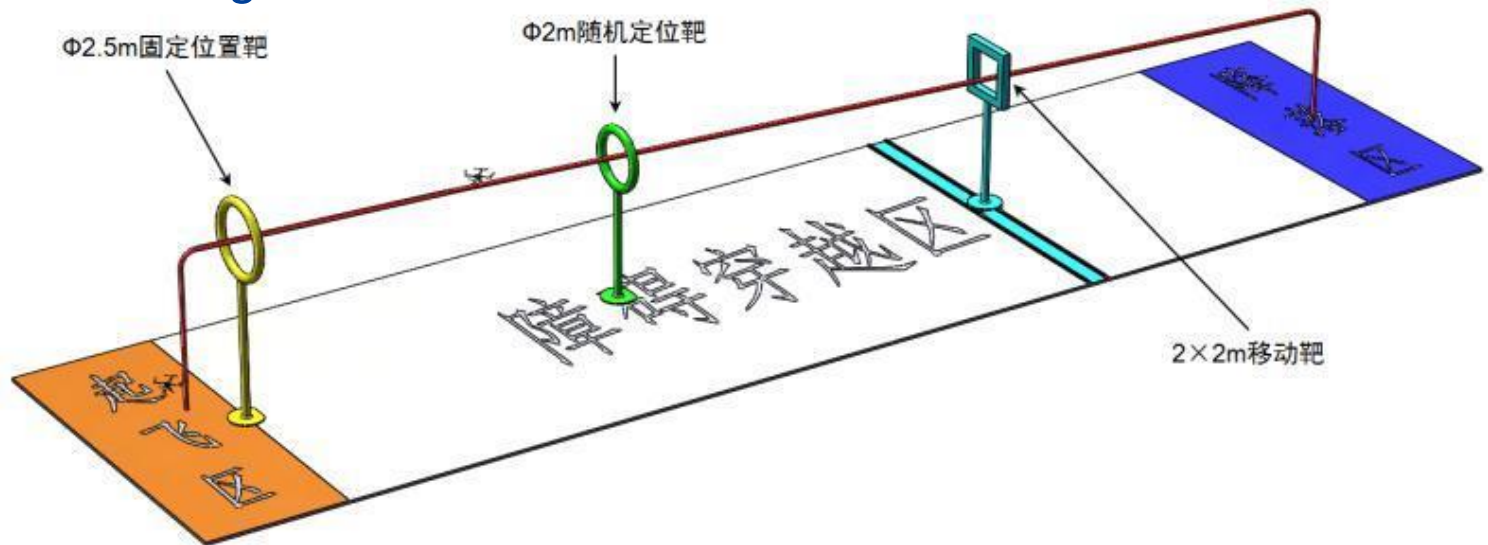
- weight $\leq 500\text{g}$
- Autonomous drone
- Intelligent flight :



Intelligent MAV Competition



- weight $\leq 500\text{g}$
- Autonomous drone
- Precision crossing :





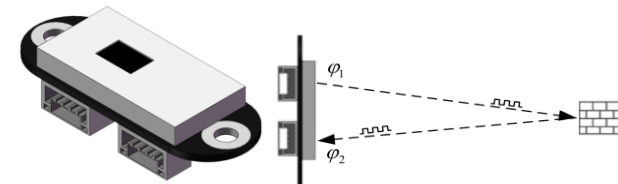
Intelligent MAV Competition- Intelligent flight



Selected hardware platform:



- Goal : Robust
- Stable platform (mavic Air+ Stable laser data (No delay))
- DJI mavic air + four laser feedback
- Flight time 21min
- 1280*960 30fps image (200ms)
- Tofsense laser+xbee communication



DJI SDK limit :



- DJI Windows SDK:
 - Limited to use C# for development: it takes a while to learn c#
 - Can only be used for UWP development, not available on other .NET-based frameworks
 - Opencv, yolo, etc. are difficult to deploy on UWP
- SDK limit:
 - Unable to get accurate local position, get latitude and longitude coordinates
 - Unable to manually control switching P, S mode
 - The amount of control can only send the amount of rocker
 - Height information can only be obtained (after fusion) barometer height, accuracy 0.1m

Software Architecture :



- The previous period took a lot of time, trying to solve only through a c# program, opencv, yolo recognition, etc.
- Finalize :
 - Do control on the C# program, the strategy section
 - The image data is passed to python via TCP protocol for opencv processing, yolo identification
 - The Python serial port issues a request for laser data and parses the serial data.
 - Ensure the smoothness and robustness of the program running inside the program, we open multiple sub-threads.

Preview:

DJIWSDKDemo



SDKRegistration SUCCEEDED

Socket Connect Failed

Start TakeOff

Stop TakeOff

Start Autoland

Stop Autoland

Fly Trajectory

Receive Msg

Hover

Camera Fucus

FlyDown

TakeOffAndFlyTraj

Register app successfully !!
 Piture frame: 1084 Size: 1280 x 960
 NED Velocity Vsum: 0.00 m/s Vx: 0.0 Vy: 0.0 Vz: 0.0
 Location2D lat: 20047671.395020700000000 lon: 10023835.697508500000000
 Hight from barometer: 0.0 m
 Attitude pitch: 0.30 roll : -0.30 yaw : 57.50
 Front : 6.12 8.22 8.22 4.02
 Back : 5.07 4.02 4.37 5.07
 Received msg: null

battery : 68
 Wifi connect status: NOT CONNECTED
 YoloResultForAlignment
 YoloDetectionResult



Forward

Back

Yaw L

UP

Yaw R

Left

Down

Right

TextBox



Debug Msg

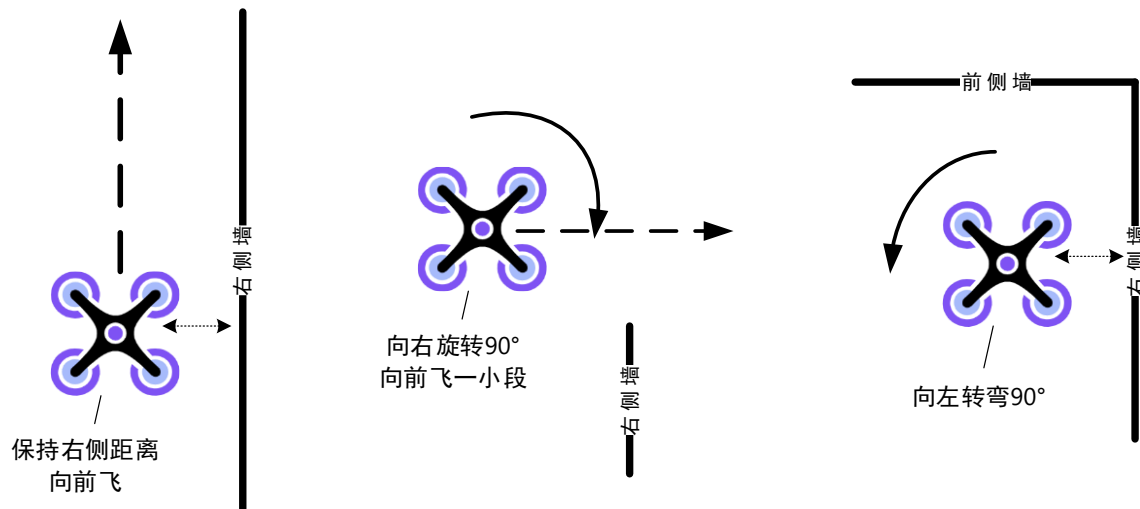
```

【00:00:0500】 【NORMAL】 UWP UI Initialize start time11/19/2019 9:27:25 PM
【00:00:0547】 【NORMAL】 don't use Send socket...
【00:00:0551】 【NORMAL】 don't use Receive socket...
【00:00:0659】 【NORMAL】 11-19-21-27-25.csv: 文件初始化完成
【00:00:0667】 【NORMAL】 路径: C:\Users\User\AppData\Local\Packages
\com.wsdm.sample_p5wrw3194ng7g\LocalState
【00:00:2414】 【NORMAL】 flight status event added
【00:01:2997】 【NORMAL】 视觉定位已开启!!!
  
```

Control Strategy:



- Fly along the wall by four-way laser feedback
- Yolo recognizes the target and flies to the front of the target
- Laser data voting decision
- Enter the cabin along the right wall, check whether the target point is reached by the lower-looking laser, record the status, and walk out of the cabin along the left wall (actually along the route of entry).



踩到的坑：



- The function that can't be realized can change the path, not necessarily stuck in this place.
 - Uwp's more difficult content can be sent to other programs through tcp communication, and other programs can be processed.
- Laser mounting angle is critical
 - (follow-up) can set offset, set fov angle, etc.
- C# control layer code Do not call asynchronously using the Async await keyword
- DJI SDK visual obstacle avoidance information can get a certain delay (more than 200), inconvenient to use
- Crack the no-fly zone restrictions: mobile phones do not connect to the Internet, or shield the aircraft GPS antenna, use computer control

Insufficient and prospect :



- Insufficient
 - Seriously dependent on the direction of the nose where the aircraft was placed
 - There is currently no way to correct the Yaw angle after the deflection.
 - The software needs to be started in a certain order, and the robustness is not high.
- Prospect :
 - Can be used for simple tracking, identification, flight

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Future Work:



- Autonomous drone + 4 or so drones, group control
- PX4 Multi-machine simulation group control area coverage

谢谢！

