

오픈소스 기반의 비행제어컴퓨터 소개 및 발전 방향

Introduction of Flight Control Computer based on Open
Source

문성태 교수

한국기술교육대학교





CONTENTS

01 INTRODUCTION

02 오픈소스 기반 비행제어컴퓨터, PX4

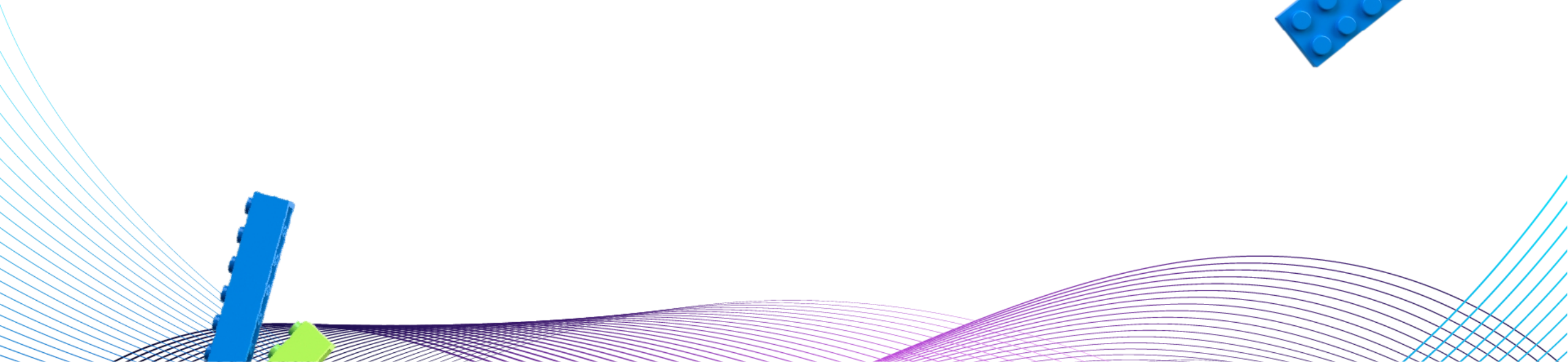
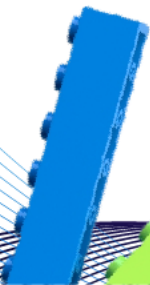
03 오픈소스 기반 비행제어컴퓨터 발전 방향





01

INTRODUCTION





**이 연구의 시작은
2013년으로 거슬러 올라갑니다...**

01

실내 군집 비행



01

AR.Drone 상용 제품 (프랑스, Parrot)



1 Linux 기반 시스템

2 WiFi 통신

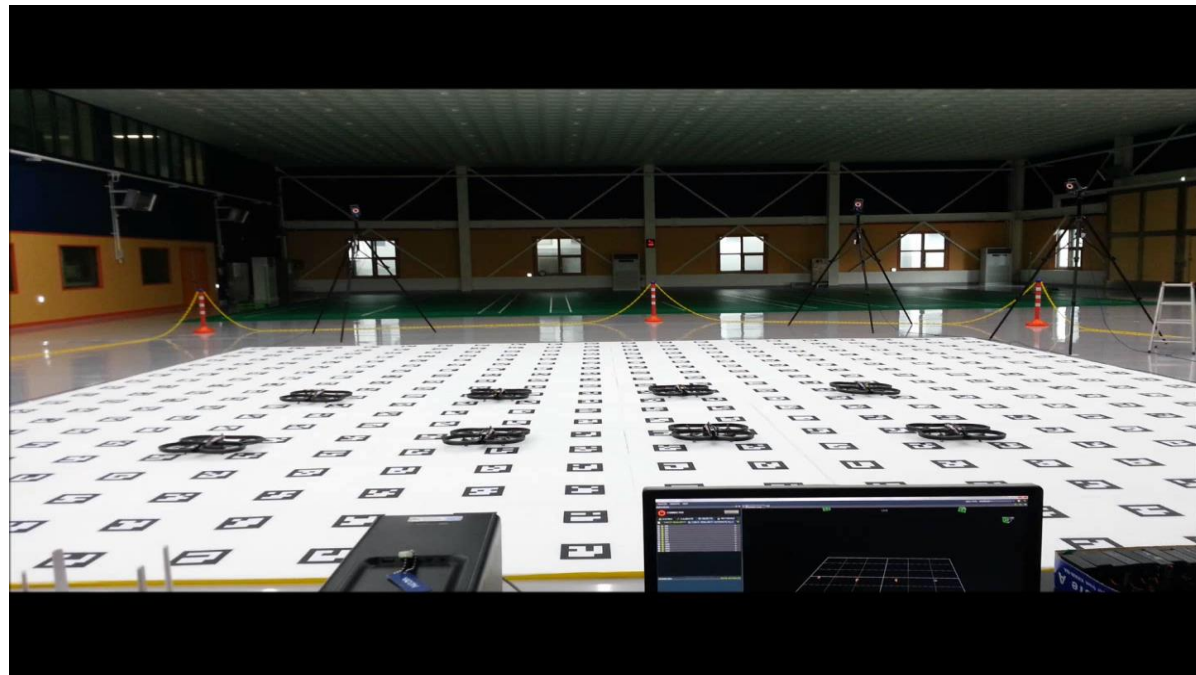
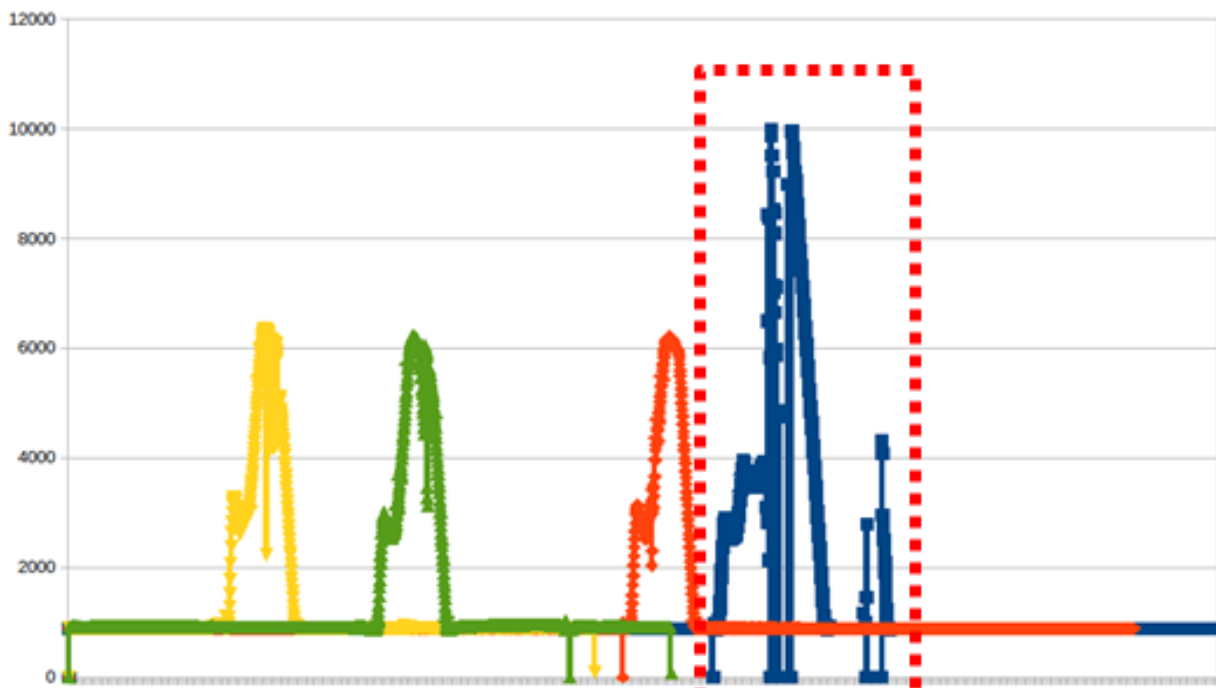
3 SDK 제공

4 저비용

01

상용 제품의 한계

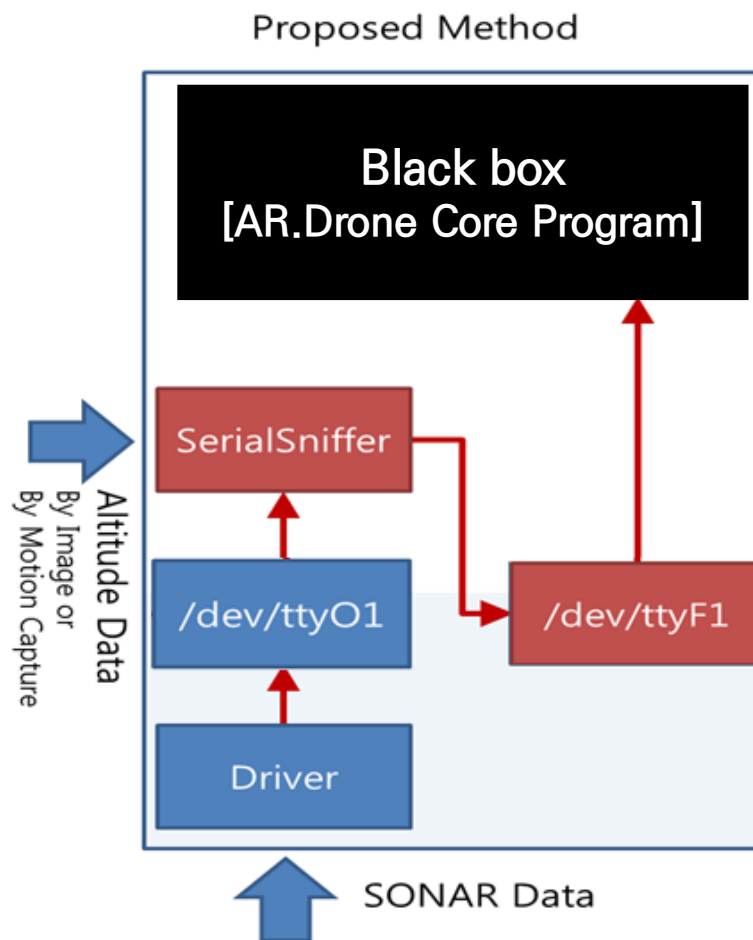
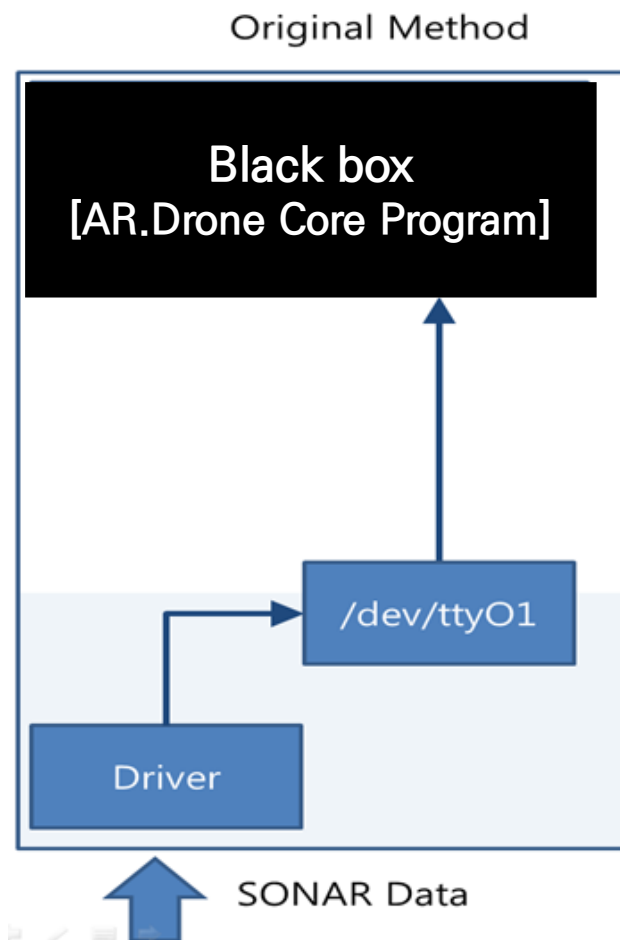
- 모든 드론들의 SONAR 센서가 동일 주파수 사용으로 인한 군집 비행 불가능



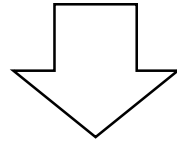
01

상용 제품의 한계

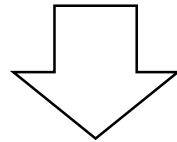
모든 드론들의 SONAR 센서가
동일 주파수 사용으로 인한 군집 비행 불가능



상용 시스템 활용의 한계



드론 시스템 개발 필요성 대두





02

오픈소스 기반 비행제어컴퓨터, PX4

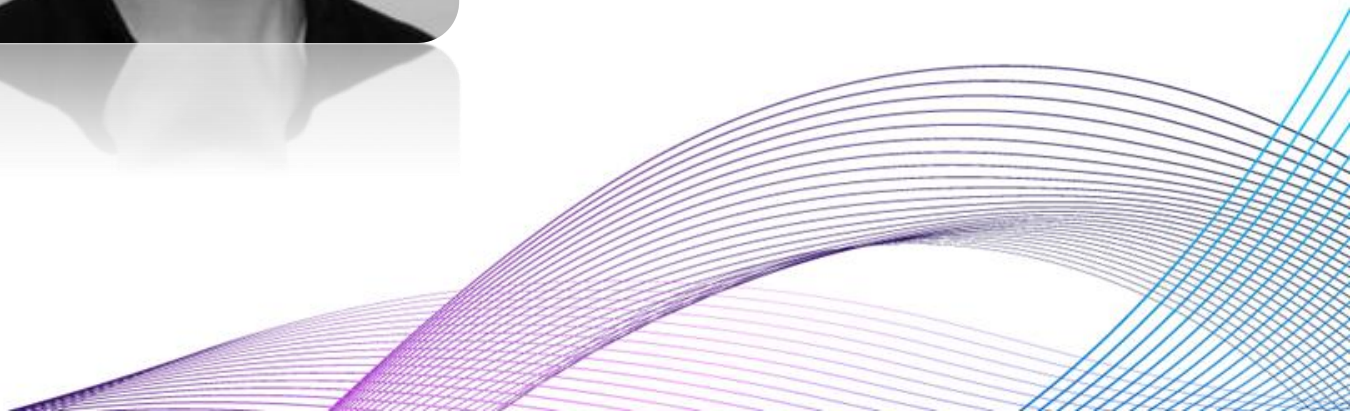




Flight Control Computer PX4

2009

Pixhawk 프로젝트 시작 (ETH Zurich. Lorenz Meier)

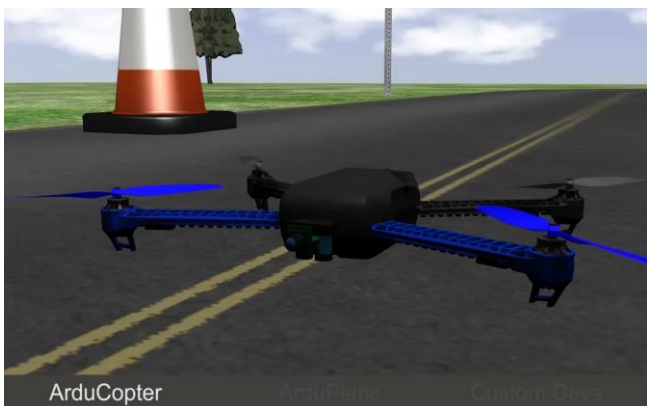
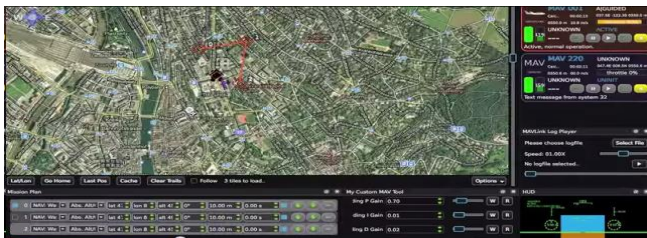


02

Flight Control Computer PX4

2009

오픈소스 기반 QGroundControl (지상국시스템), MAVLink(통신 프로토콜) 개발



02

Flight Control Computer PX4

2009

European Micro Air Vehicle Conference and Flight 대회 Indoor Autonomy 부분 우승

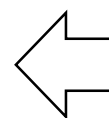
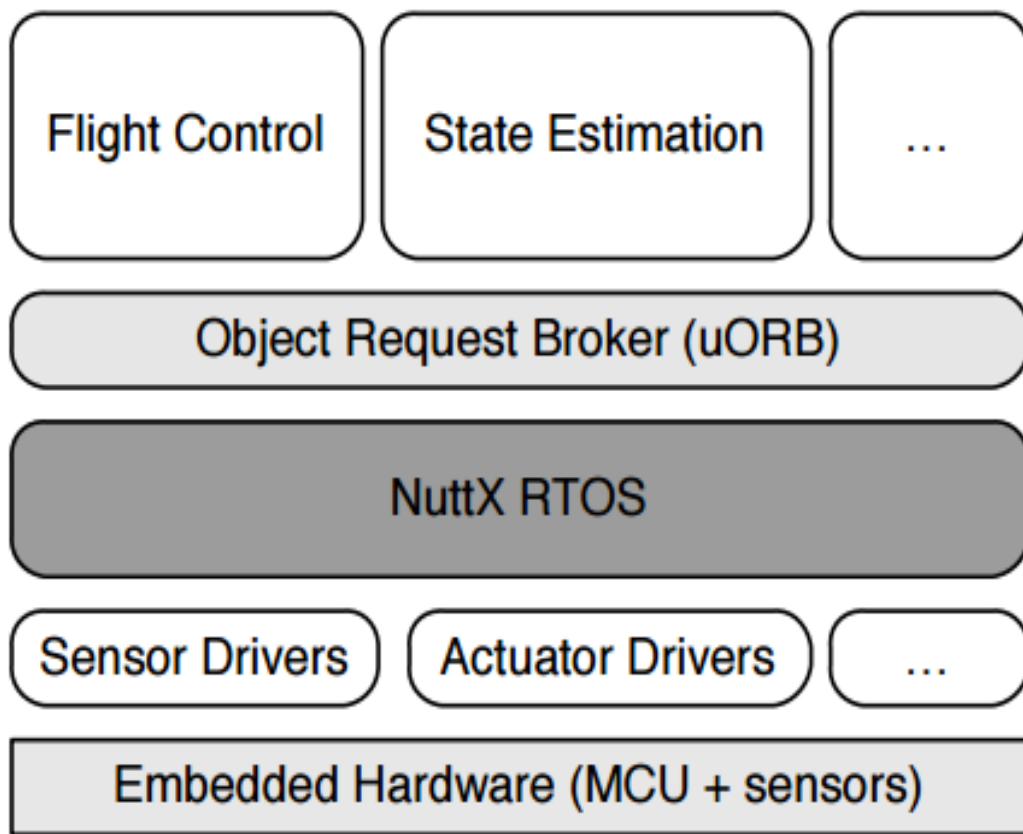
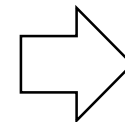


02

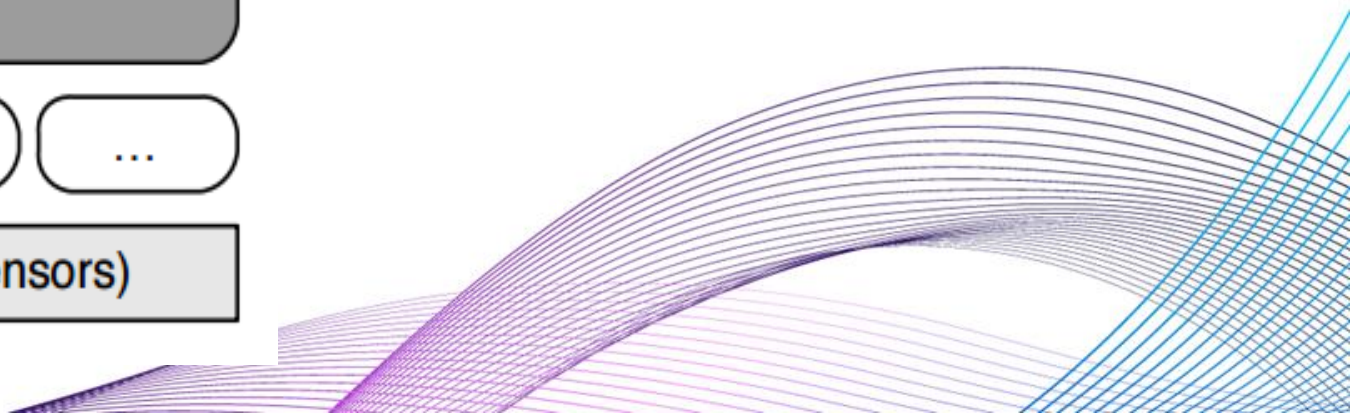
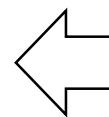
Flight Control Computer PX4

2011

오픈소스 기반 비행제어컴퓨터 PX4 탄생



...



02

Flight Control Computer PX4

2013

오픈소스 비행제어컴퓨터 PX4 하드웨어 Pixhawk 출시 (with 3D Robotics)

- First and second generation hardware (Flight Management Unit version 2: FMUv2)

PX4 and 3D Robotics present Pixhawk: An Advanced, User-Friendly Autopilot

✈ By Press 29 August 2013



Who builds PX4?



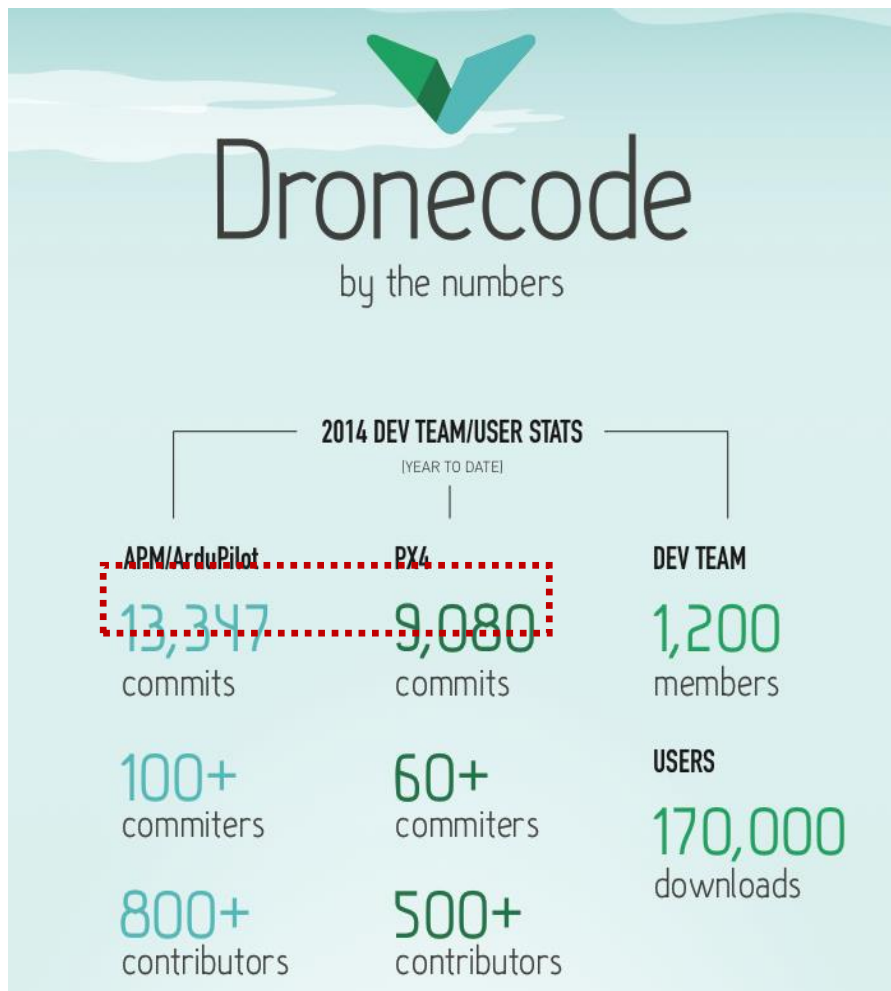
...and many more!

02

Flight Control Computer PX4

2014

리눅스 재단에서 드론코드 설립



PROJECT MEMBERS

Platinum



Gold



Silver



02

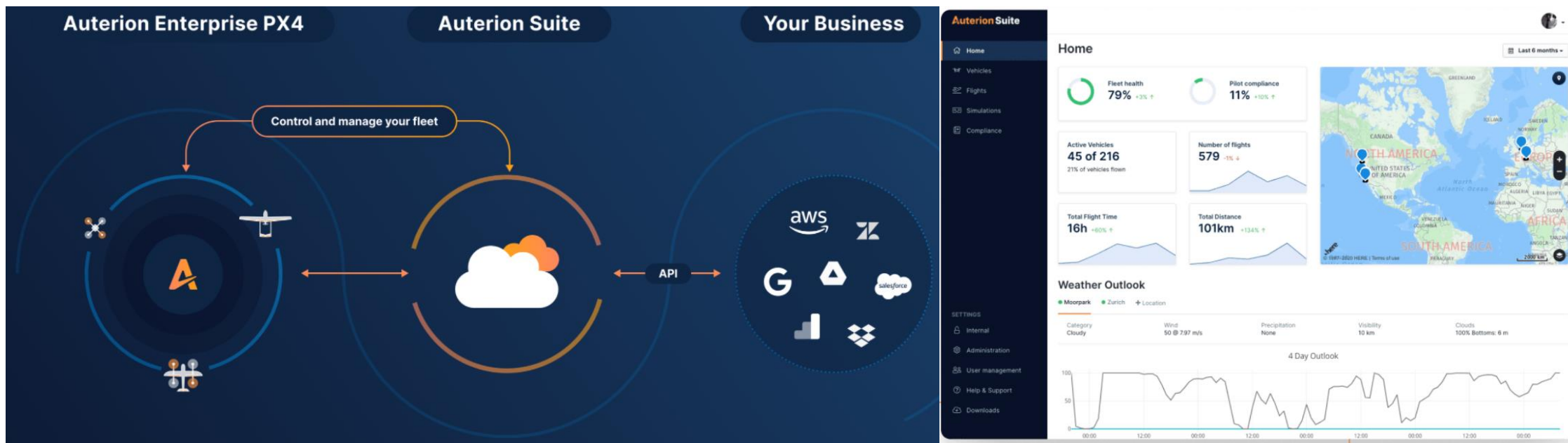
Flight Control Computer PX4

2017

Lorenz Meier Auterion 회사 설립

- 안정적인 PX4 관리 지원
- 드론 통합 운용 플랫폼 개발

Auterion



02

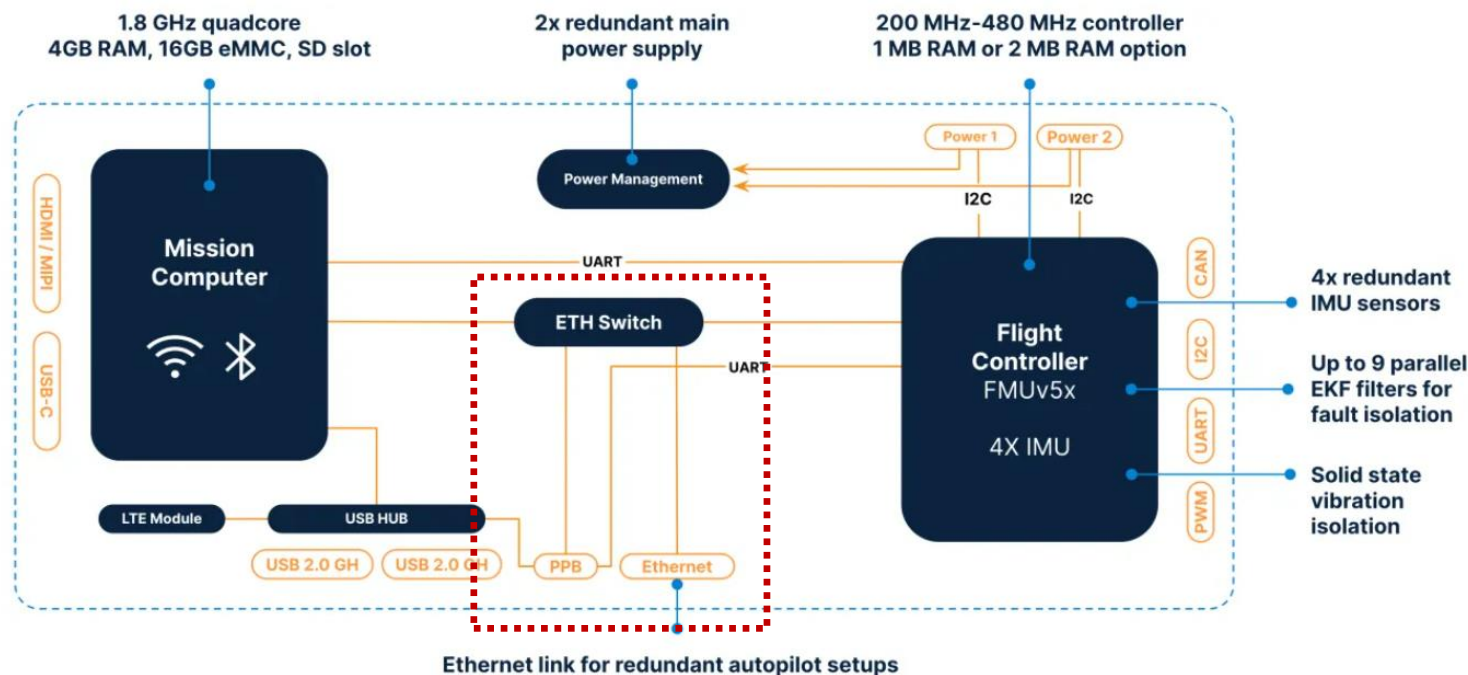
Flight Control Computer PX4

2017

엔터프라이즈급 비행제어컴퓨터 (skynode) 개발

- Built-in Ethernet, USB, WiFi, 4G
- Pre-integrated camera and payload lineup
- Connected to online services in the cloud
- Container platform to host your own onboard apps

Auterion

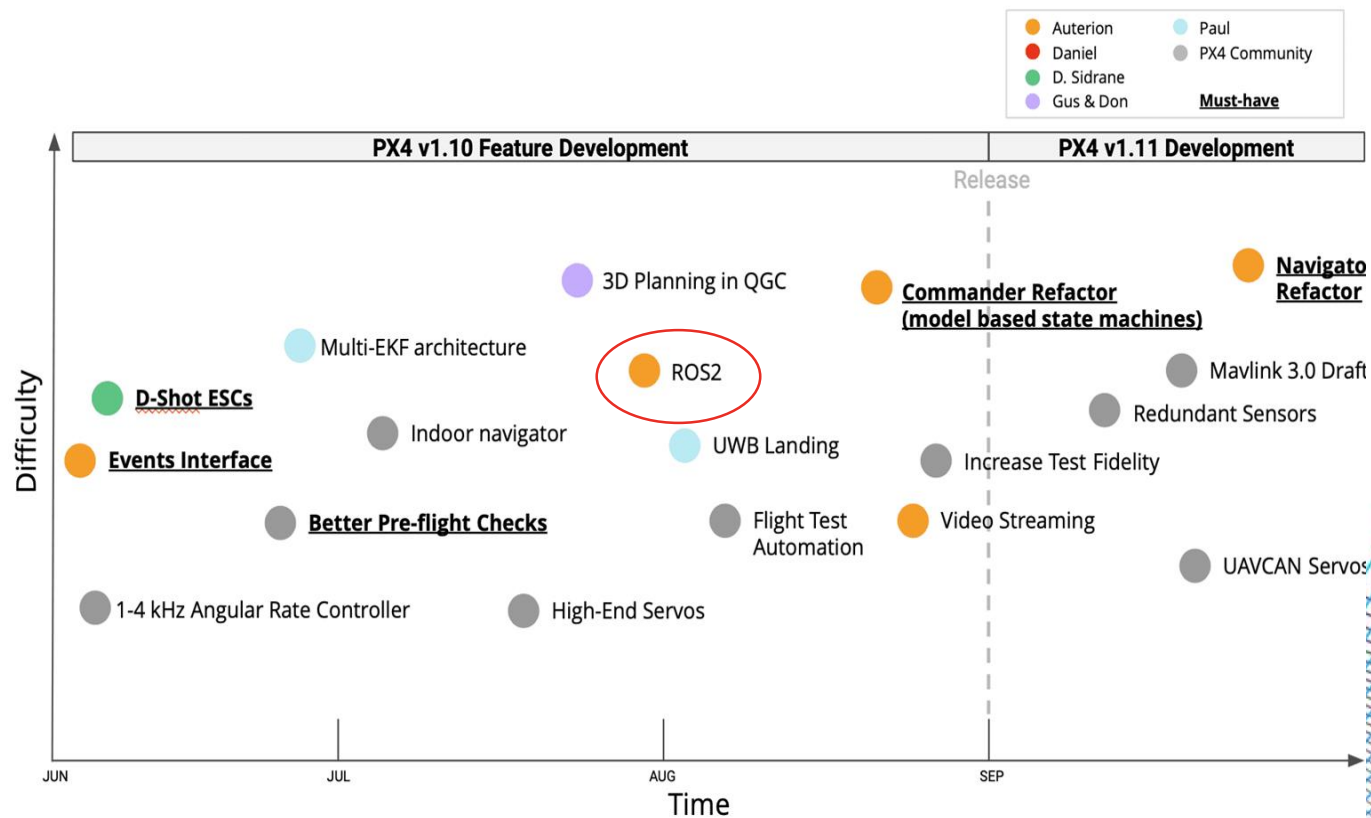
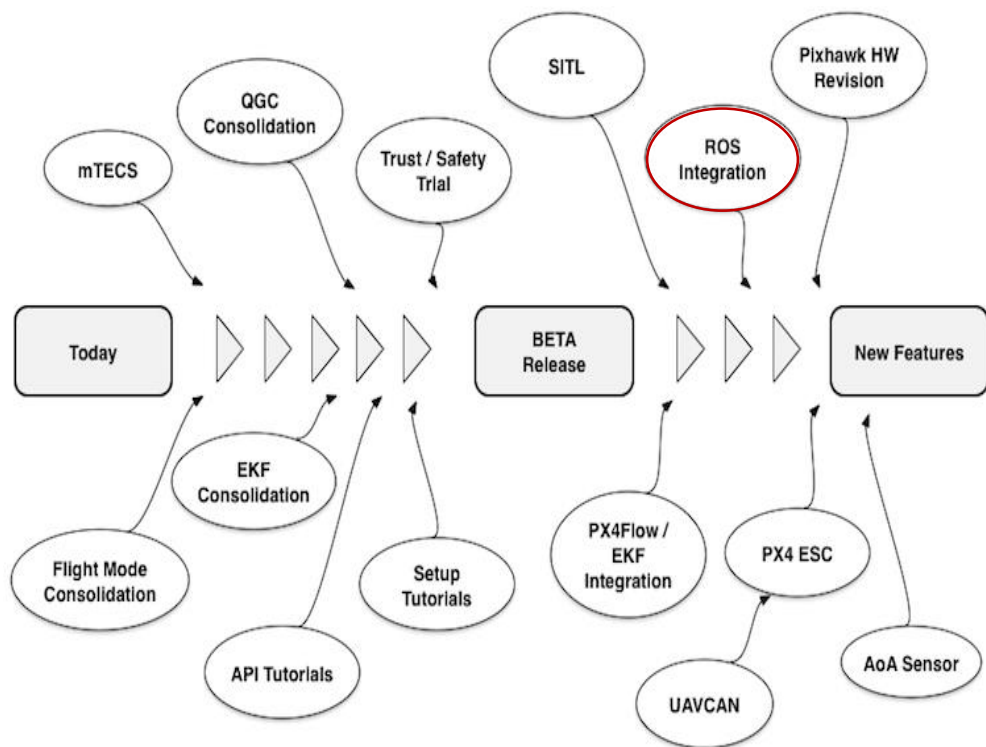


02

Flight Control Computer PX4

2019

ROS(Robot Operating System) 와의 통합 완료



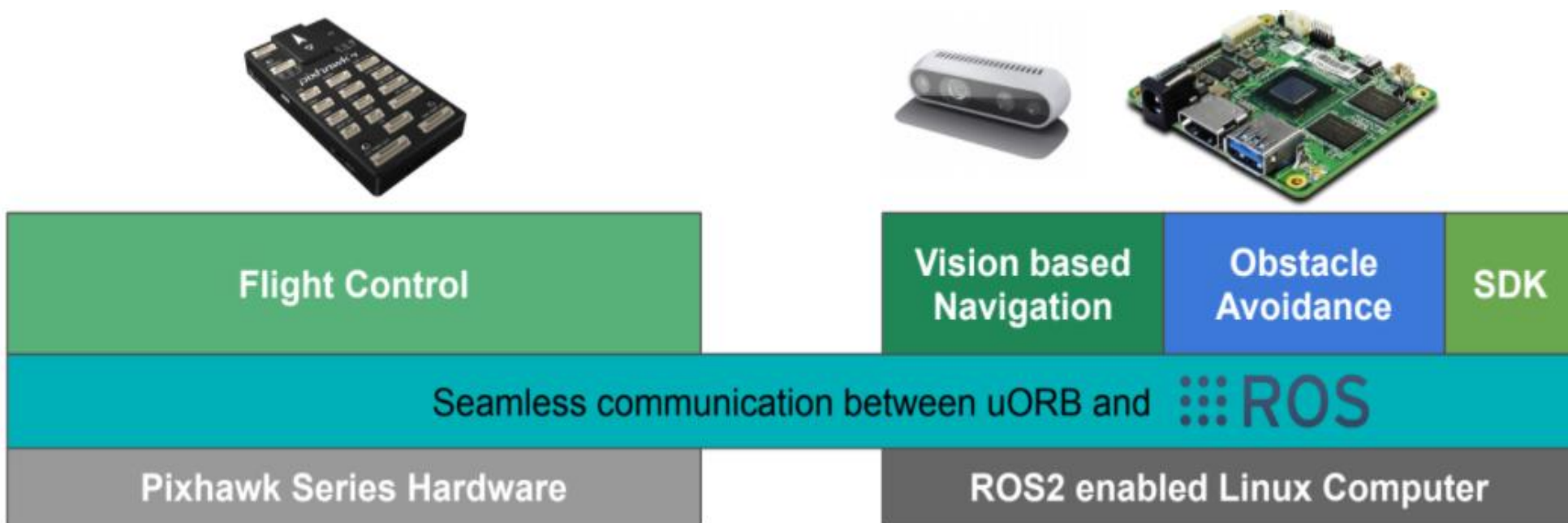
02

Flight Control Computer PX4

2019

ROS(Robot Operating System) 와의 통합 완료

- PX4 supports native communication with ROS2 via FastDDS





Flight Control Computer PX4

2020

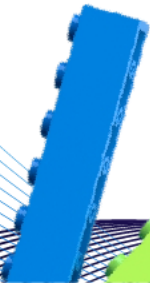
Pixhawk 산업 표준안 공개





03

오픈소스 기반 비행제어컴퓨터 발전 방향



03

임무/서비스 중심 연구 개발

- 임무/서비스 중심의 연구 개발 증가
 - Flight Computer는 안정화, 표준화 방향
 - Mission Computer는 임무 중심 연구 방향
 - Flight Computer + Mission Computer 통합 방향

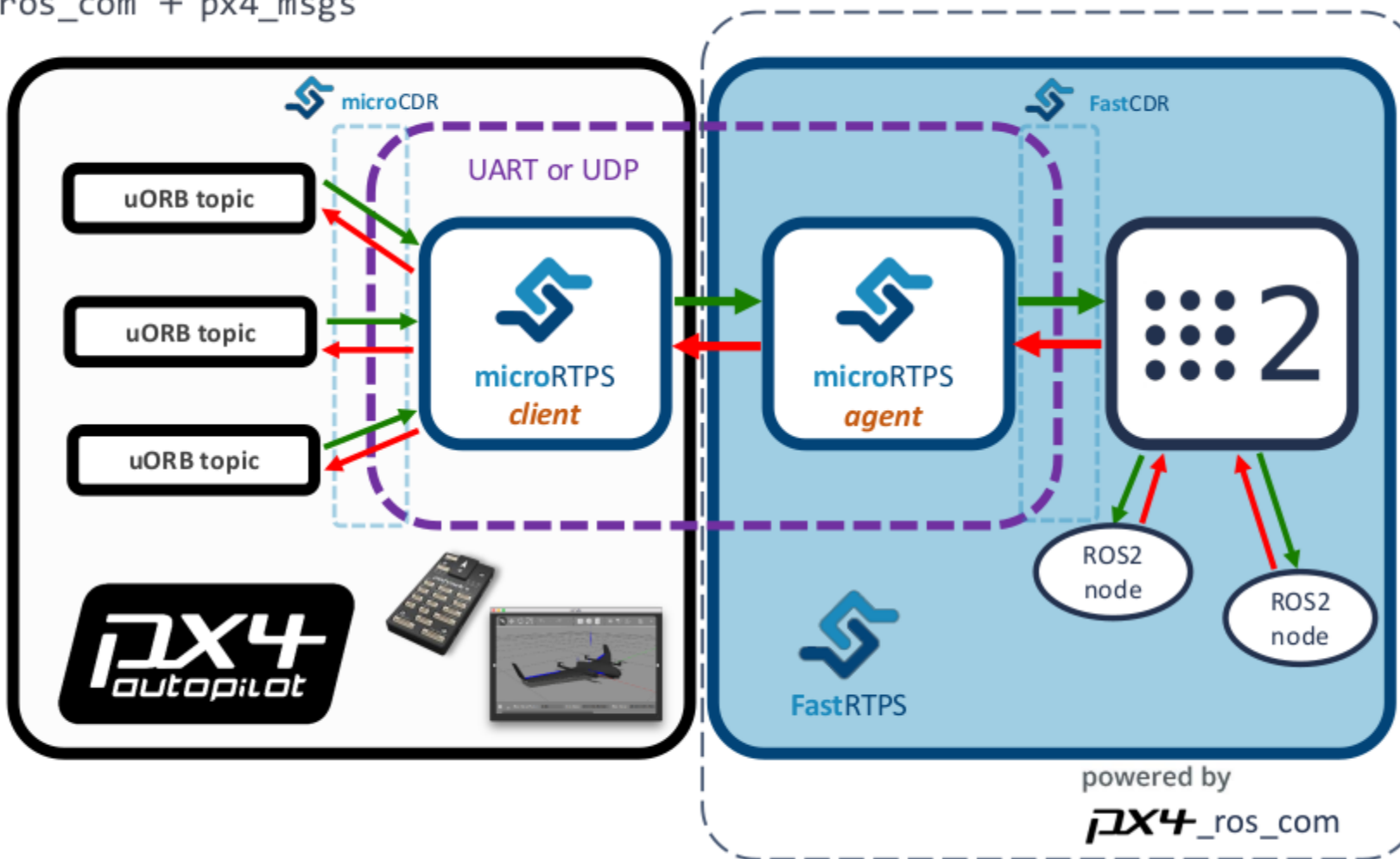


03

임무/서비스 중심 연구 개발

PX4-ROS2

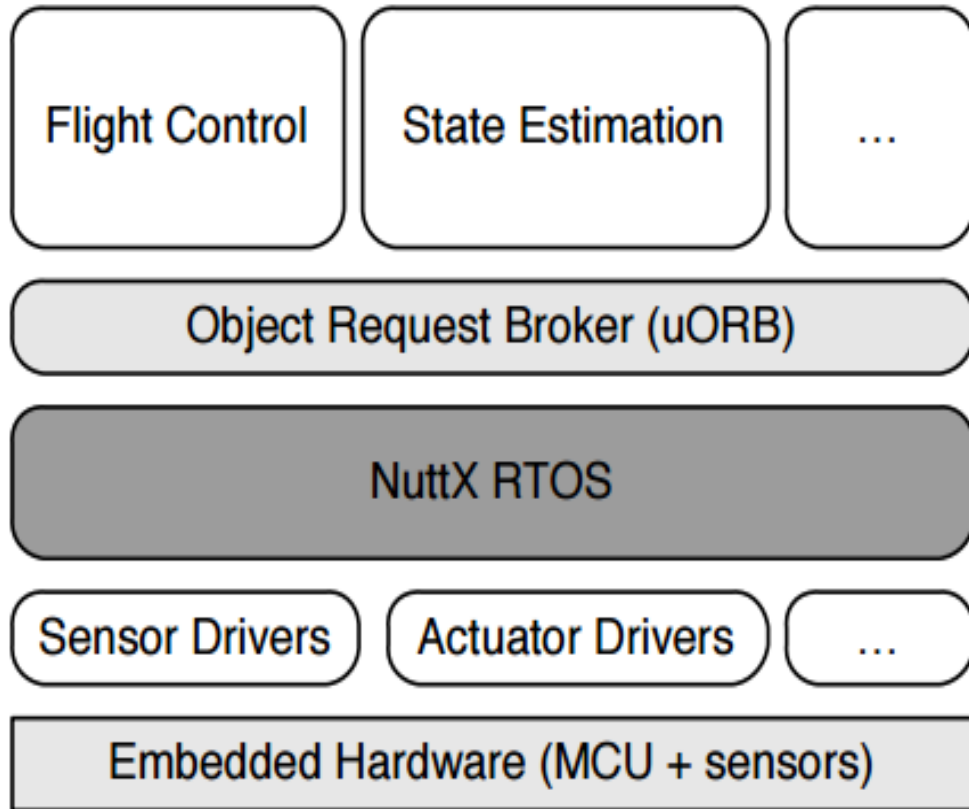
px4_ros_com + px4_msgs



Refer to

03

보안 기능 강화



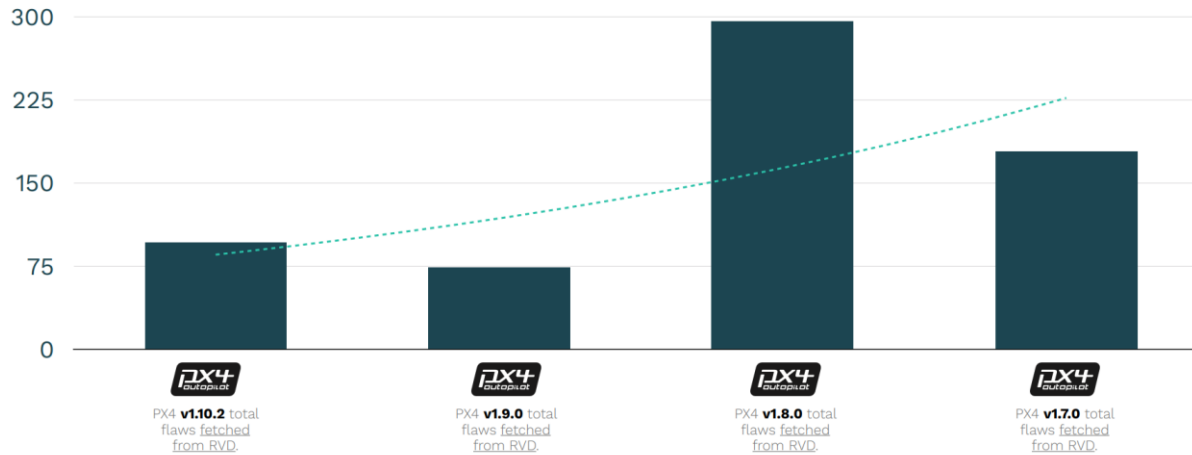
- Security classification for the PX4 eco-sytem
- Signature checking for the boot script
- Default RTOS (NuttX) Configuration
 - Ethernet
- Topic Security
- Unauthorized user modification of UAV setting

03

보안 기능 강화

SECURITY FLAWS BY RELEASE

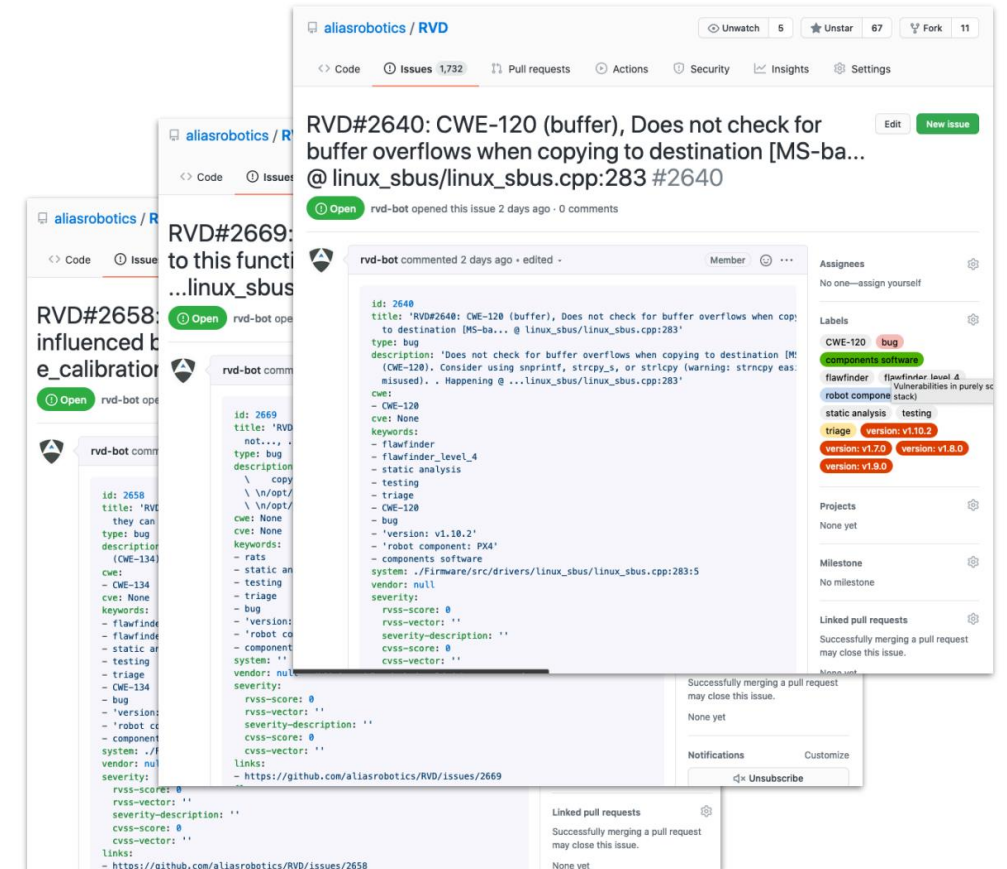
● cppcheck ● Flawfinder ● Rats ● bandit



	OPEN	CLOSED	ALL	
VULNERABILITIES	Vulnerabilities 209	Vulnerabilities 12	Vulnerabilities 221	
BUGS	Bugs 1523	Bugs 257	Bugs 1780	
OTHERS	Others 0	Others 1	Others 1	
VULNERABILITIES (OPEN)	Vuln.Critical 57	Vuln.High 75	Vuln.Medium 33	Vuln.Low 2

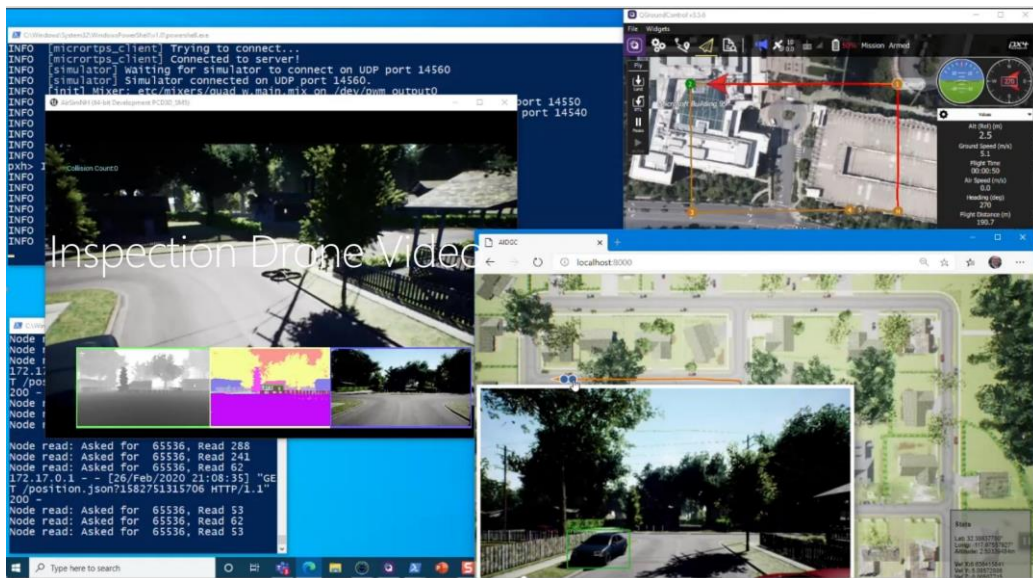
Last updated Wed, 01 July 2020 20:24:48 GMT

Robot Vulnerability Database (RVD), <https://github.com/aliasrobotics/RVD>



03

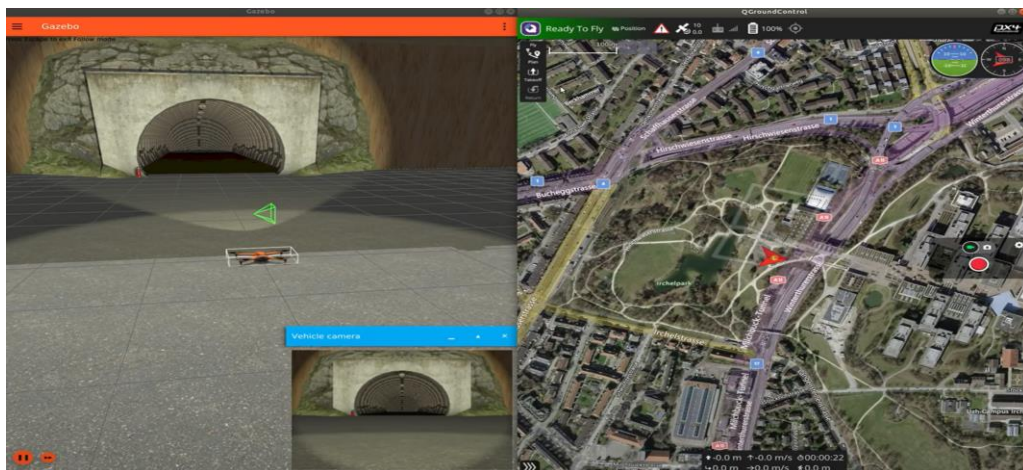
시뮬레이션 기능 강화



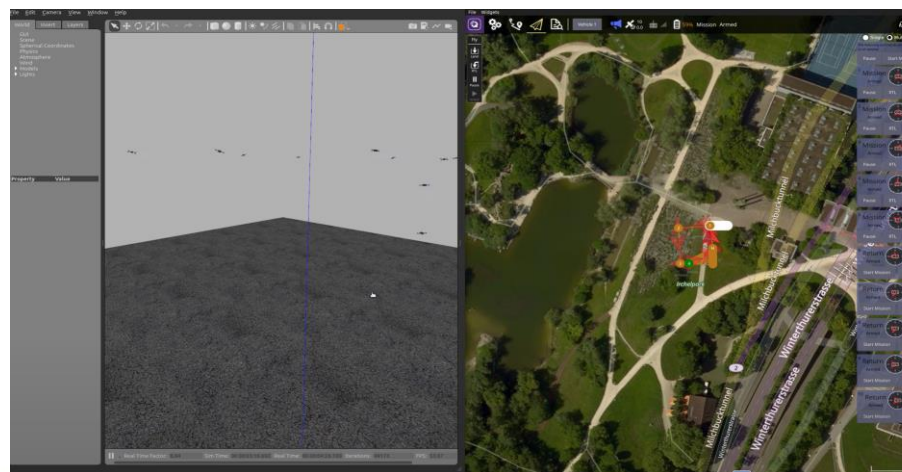
[Airsim]



[JMAVSim]



[Ignition]



[Gazebo]

감사합니다

오픈소스 기반의 비행제어컴퓨터 소개 및 발전 방향

