
# 2019 Fall Design Review

# VisHawk Team

Development Team Members:

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Team Sponsors:

- Alan Jaeger - Navsea
- Dr. Yogananda Isukapalli - UCSB ECE

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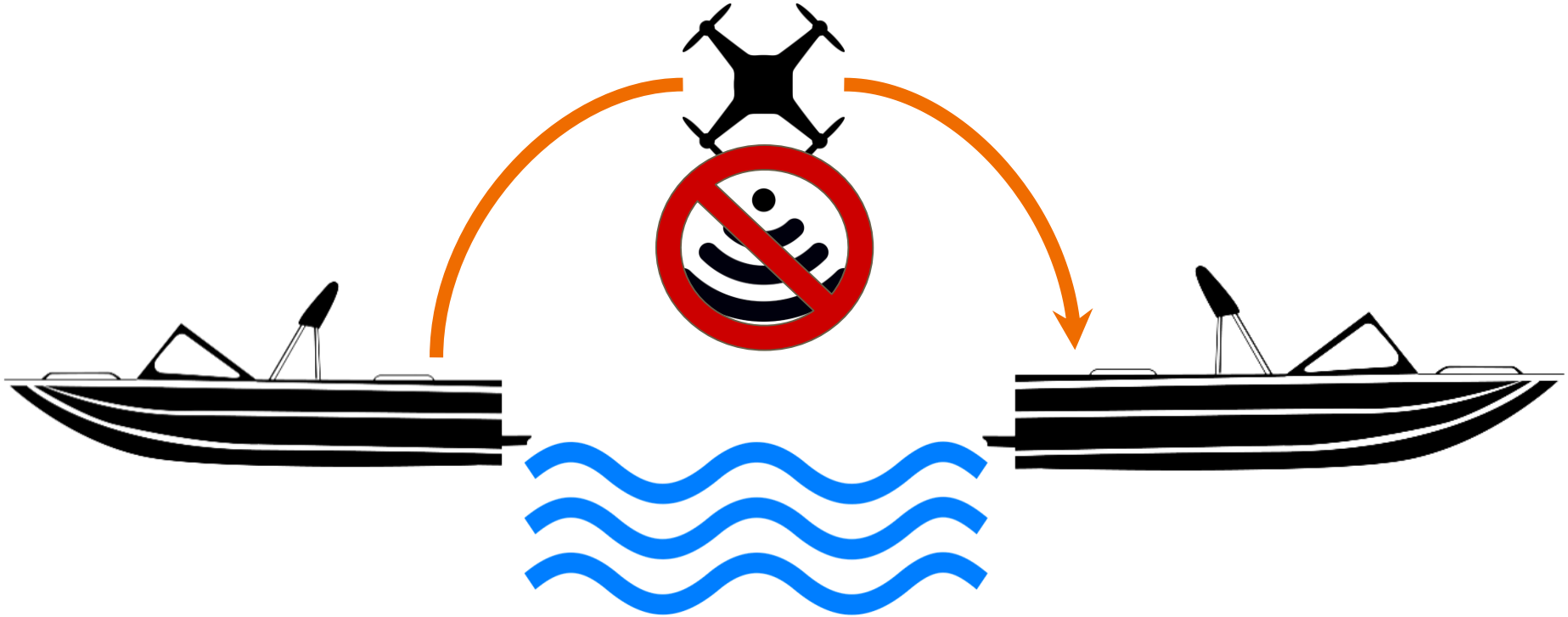
# Overview

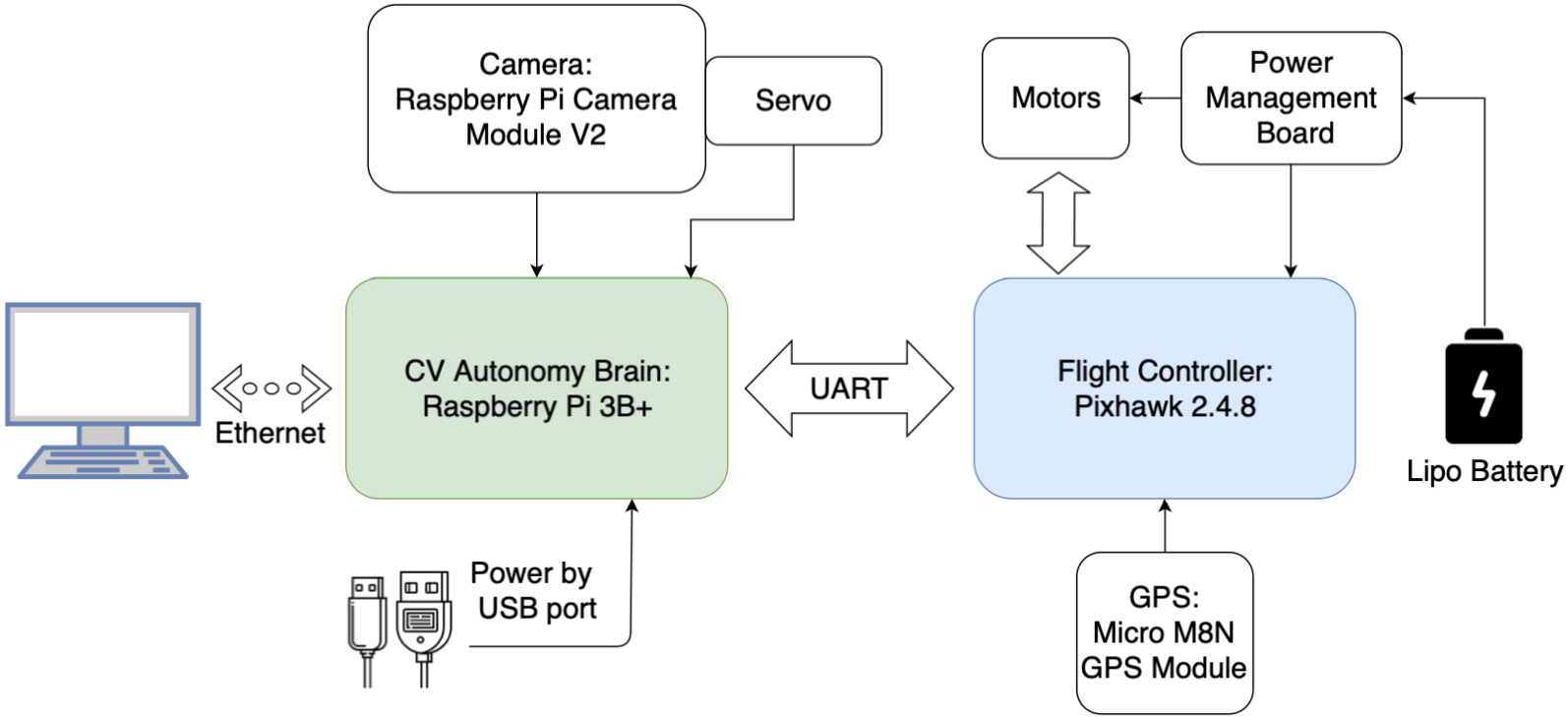
VisHawk project is pursuing RF-silent autonomous flight of multirotor UAVs between ships underway at sea. We implement this behaviour by guiding the final approach with Apriltag visual fiducials. Using GPS and a known initial trajectory of the landing vessel, VisHawk closes to within visual range of the vessel. VisHawk then uses the visual marker to produce a safe approach trajectory, updating in real time to consider uncertainties such as sea conditions moving the deck of the landing vessel.

tl;dr? To fly drones between ships without radio communication.

# Problem Formalization



# Block Diagram



# Progress | Hardware

- ReadyToSky Pixhawk 2.4.8 controller
- Raspberry Pi 3b+ vision computer
- 8 megapixel RPi camera
- 450mm YoungPower quad frame
- 920kV long-distance efficient motors

Current hardware assembly progress!

# Companion Computer | Details

- Raspberry Pi 3B+
- Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53
- Power Supply:
  - 5V/2.5A DC via micro USB connector
  - 5V DC via GPIO header
  - Power over Ethernet (PoE)–enabled (requires separate PoE HAT)
- Internal Memory:
  - 1 GB LPDDR2
- External Memory:
  - 32 GB MicroSD card
- Operating System: Raspbian Buster Lite

# Flight Controller | Details

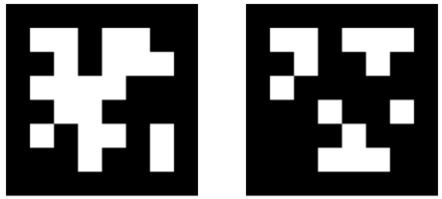
- PixHawk v2.4.8
- 32-bit ARM Cortex M4 core with FPU
- 168 Mhz/256 KB RAM/2 MB Flash
- 5x UART (Serial Ports)
- 3.3 and 6.6V ADC inputs
- Software Sources:
  - QGroundcontrol
- Protocol for Communication:
  - MAVLink

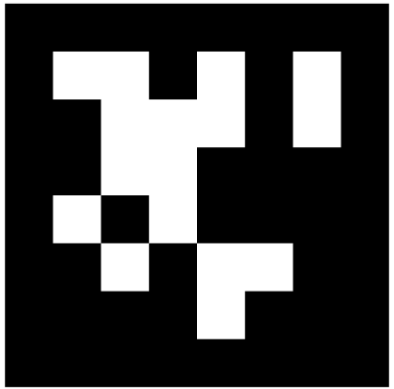
# Sensor | Details

- Raspberry Pi Camera 2
- 8 megapixel camera capable of taking photographs of 3280 x 2464 pixels
- Capture video at 1080p30, 720p60 and 640x480p90 resolutions
- All software is supported within the latest version of Raspbian Operating System

# Progress | Software

- Setup of Python3 interfaces to Apriltags3
- Multithread camera I/O working
- 25FPS 36h11 Apriltag Recognition
- 7.5 cm tag works consistently at 1.5m!
- HW Servo control demonstrated in software.





Multiscale AprilTag3:
Two-scale 36h11 tags
Under testing!

# Future Goals

End of Fall 2019:

- Drone flight testing
- Apriltag range testing

Winter 2020:

- Complete interfacing between Pixhawk and Raspberry Pi
- Autonomous stationary-to-stationary and moving-to-stationary flight

Fall 2020:

- Moving-to-moving flight testing and improvements

# Acknowledgements

**Dr. Yogananda Isukapalli, CE Capstone Project Instructor**

**Aditya Wadaskar, TA**

**Kyle Douglas, TA**

**Alan Jaeger, Navsea Representative**

**Navsea, Project Sponsor**

# QUESTIONS?