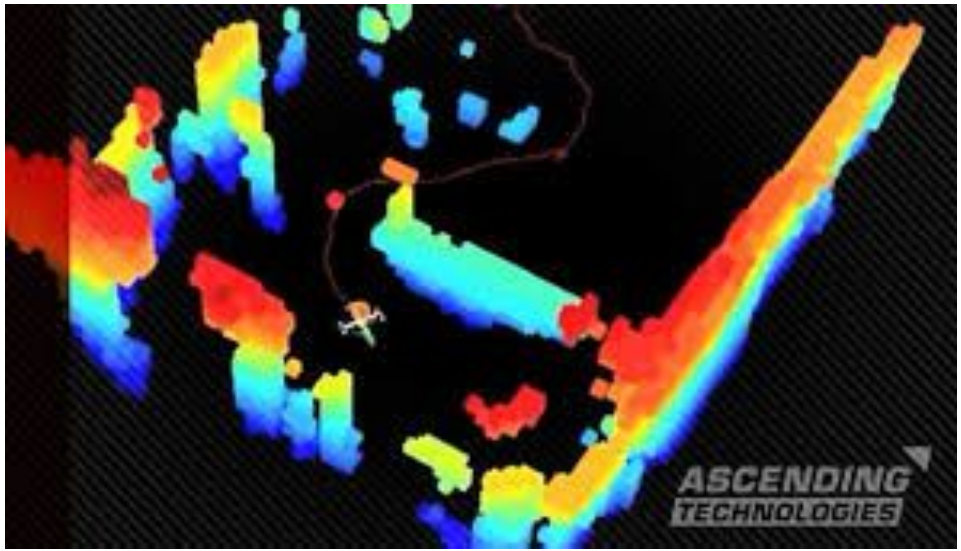
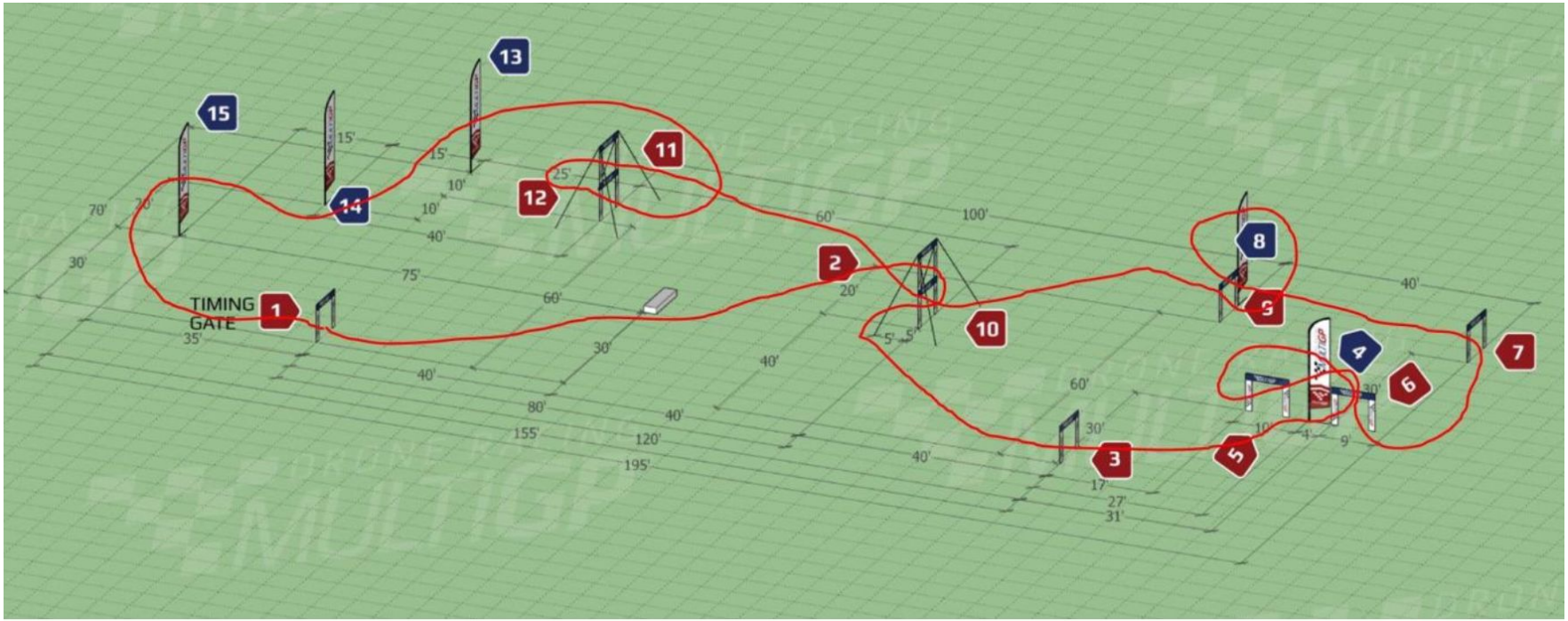
AutoQuads Overview

Our Goal

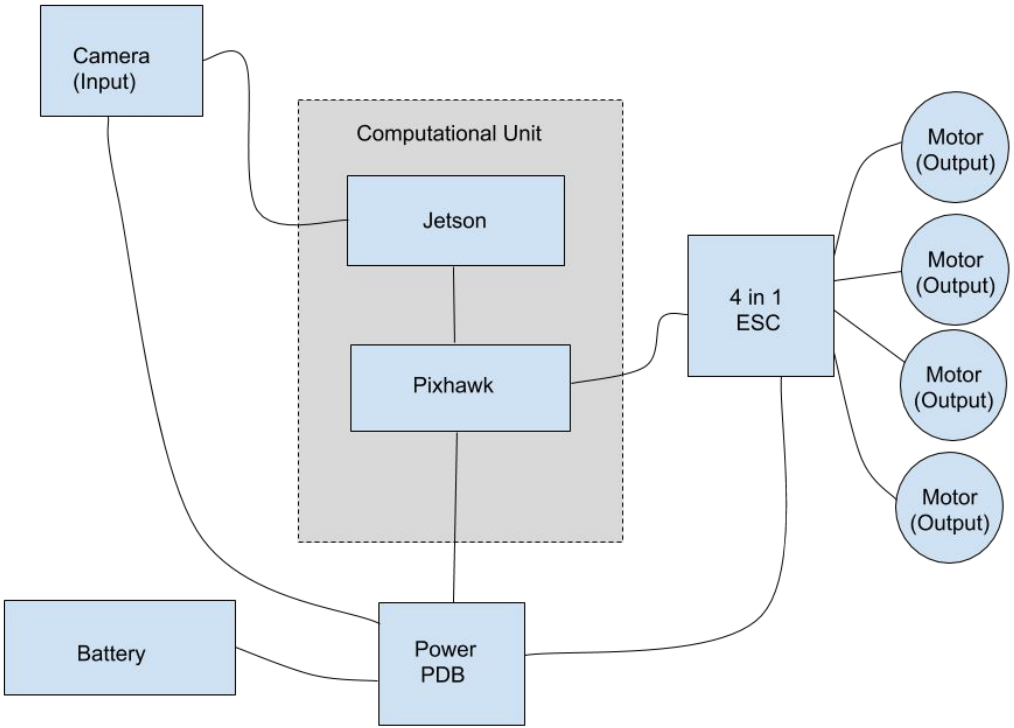
- Build a drone that can autonomously fly through a racing course (with course knowledge apriori)



Possible Race Track



Proposed Flight System



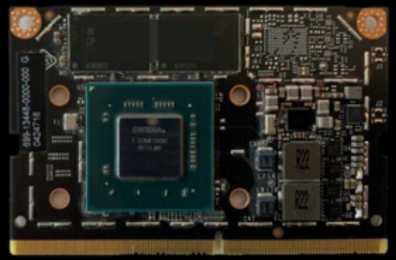
- **Nvidia Jetson Nano**: computer used to perform computer vision and path planning.
- **Pixhawk**: flight controller to keep drone in air.
- **ESC:** Electronic Speed Controller used to send signals directly to motor.

Hardware: Drone Kit

- Most work on drone system will be in software, not hardware; perception, control, data networking, path planning
- Drone kits are cheap, readily available, and reliable.

Computing Unit

JETSON NANO SPECIFICATIONS

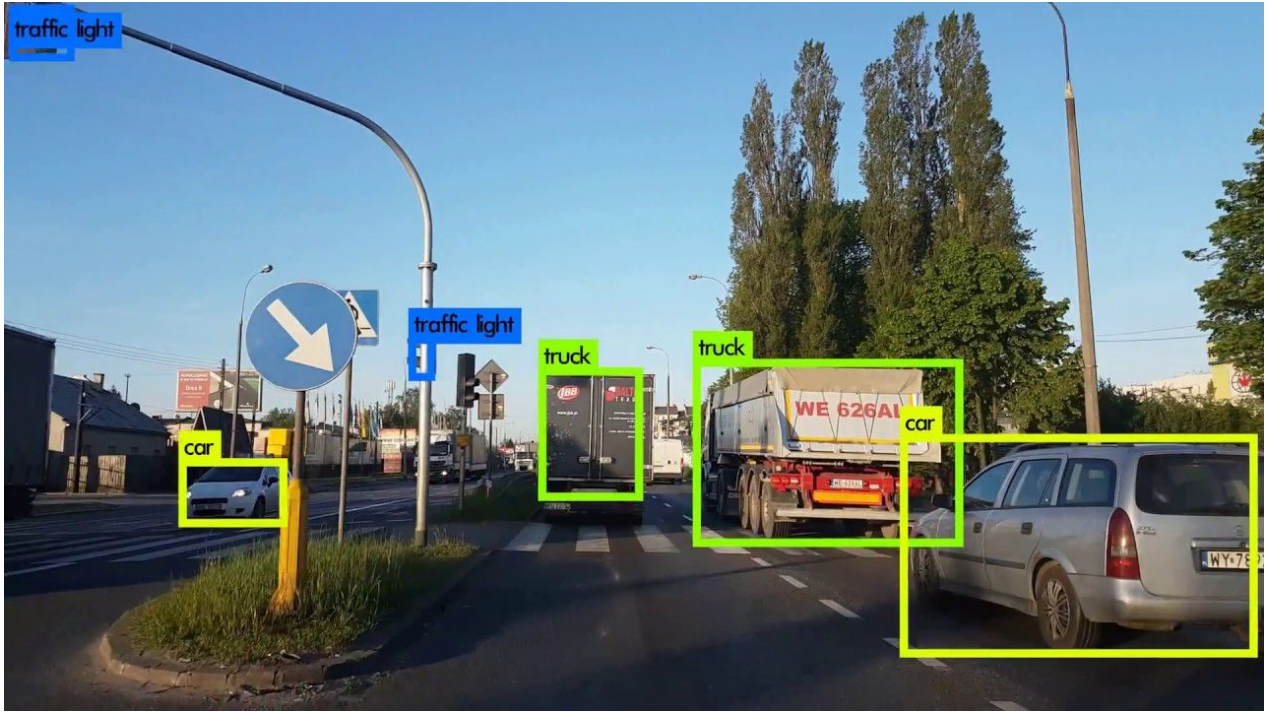


GPU	128 Core Maxwell 472 GFLOPs (FP16)
CPU	4 core ARM A57 @ 1.43 GHz
Memory	4 GB 64 bit LPDDR4 25.6 GB/s
Storage	16 GB eMMC
Video Encode	4K @ 30 | 4x 1080p @ 30 | 8x 720p @ 30 (H.264/H.265)
Video Decode	4K @ 60 | 2x 4K @ 30 | 8x 1080p @ 30 | 16x 720p @ 30 | (H.264/H.265)
Camera	12 (3x4 or 4x2) MIPI CSI-2 DPHY 1.1 lanes (1.5 Gbps)
Display	HDMI 2.0 or DP1.2 | eDP 1.4 | DSI (1 x2) 2 simultaneous
UPHY	1 x1/2/4 PCIE 1 USB 3.0
SDIO/SPI/SysIOs/GPIOs/I2C	1x SDIO / 2x SPI / 5x SysIO / 13x GPIOs / 6x I2C

Estimated Cost

Product Description	Quantity	Unit Price ($)	Total Price ($)
Drone	2	280.00	560.00
NVIDIA Jetson	3	119.00	357.00
Camera	2	80.00	160.00
Batteries	4	20.00	80.00
Obstacles	15	5.00	75.00
Total Cost			1232.00

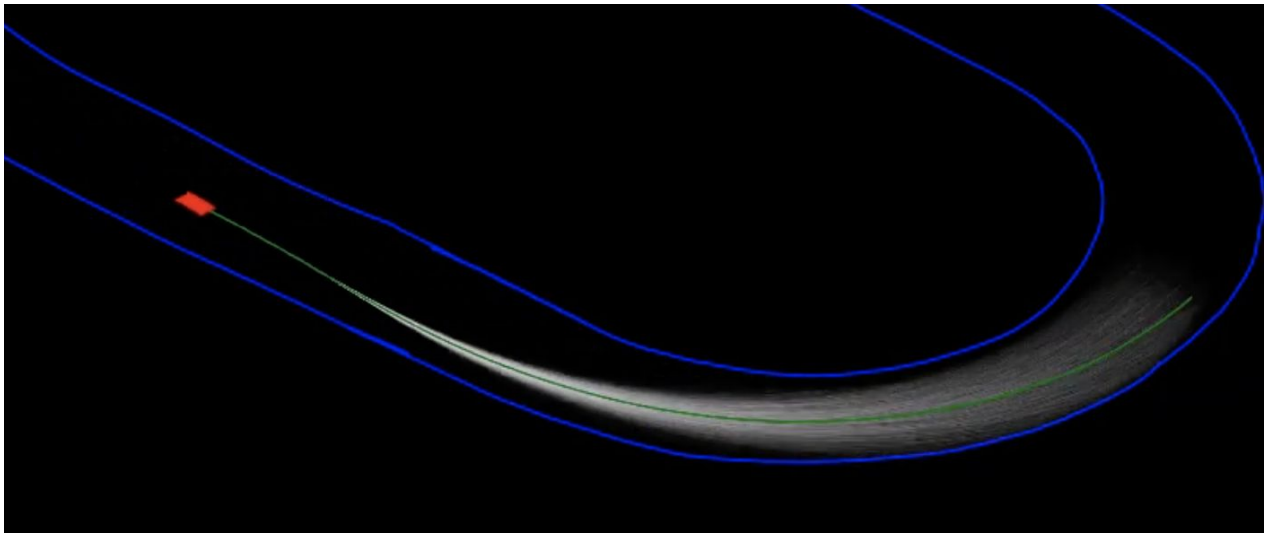
Machine Vision



OpenCV algorithms used on the Jetson will detect and locate objects in the drone’s reference frame.

Path Planning

- Using a Model Predictive Controller, like AutoRally's MPPI, and the obstacle locations, the Jetson will compute possible trajectories and choose the best one



Team Members

- Max Rudolph
- Eddie Stevens
- Dave Patel
- Rishov Sarkar
- Michael Bermudez
- Nyair Najieb
- Suhani Jain

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Advisor: Dr. Jennifer Hasler