



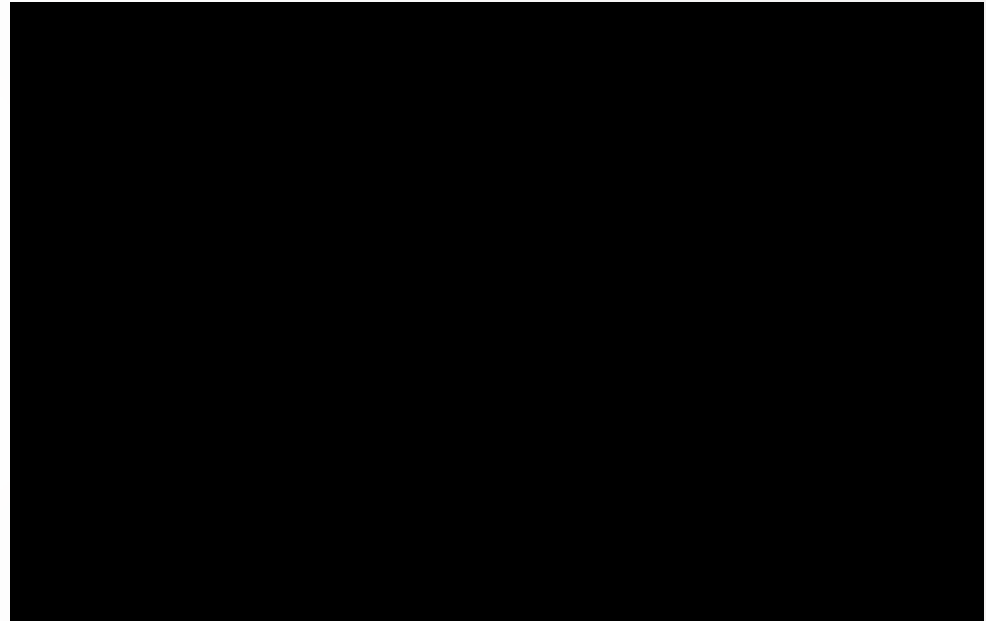
# CS691: Introduction to Aerial Robotics

Agile Multirotor Flight and Control through Smart Devices

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# Motivation and Problem Description

- ▶ Goal of Project:
  - ▶ No previous exposure to MAVs, so as broad-as-possible project, including:
    - ▶ Hardware
    - ▶ Flight Software
    - ▶ Middleware
    - ▶ Control Software
  - ▶ Problem tackled
    - ▶ A scaled down, prototype-level version of the ongoing lilycamera commercial project
    - ▶ Use iOS phone instead of dedicated gizmo
    - ▶ Eventual use cases:
      - ▶ Follow runner
      - ▶ Ultimate goal: Follow skier at 60mph, open-terrain



- Est. Release Date September 2016
- \$900, 20 minute max. flight time
- Berkeley Students
- 15M raised, seed money and Series A

# Original Proposed Approach

## ▶ Early Design Decisions

- ▶ Use iOS for control
  - ▶ Use Swift, Xcode 7 for programming
- ▶ Use quadrotor for speed, agility
  - ▶ off-the-shelf basic X240 frame
- ▶ Use OpenPilot 3CCD Autopilot hardware
  - ▶ Modify software directly on Autopilot
- ▶ Use WiFi for communication iOS to MAV

## ▶ First Lessons Learned

- ▶ Flying is hard!
  - ▶ Transformation matrix in your head – nah!
  - ▶ Result – PTSD MAV
- ▶ Batteries are very delicate
- ▶ “Soldering! Are you kidding me?”
  - ▶ In Powerpoint speak: “Industry is nascent”
  - ▶ Interconnectivity very limited
  - ▶ Everything is its own, huge world
    - ▶ Batteries, ESC, motors
    - ▶ Connector alphabet soup
- ▶ Very rapid change
  - ▶ E.g., OpenPilot Near-Death-Experience

**Very similar to PC Industry in early 1980s, Internet in early 90s**

**Therein lies the fun!**

Result: Needed to make significant changes

# New approach and current System Description

## Key Changes:

- Add a new high-level general-purpose processor to control Autopilot
- Gave up on 3CCD: Use PixRacer PX4 brand-new autopilot board/software
- Build new quadrotor from scratch



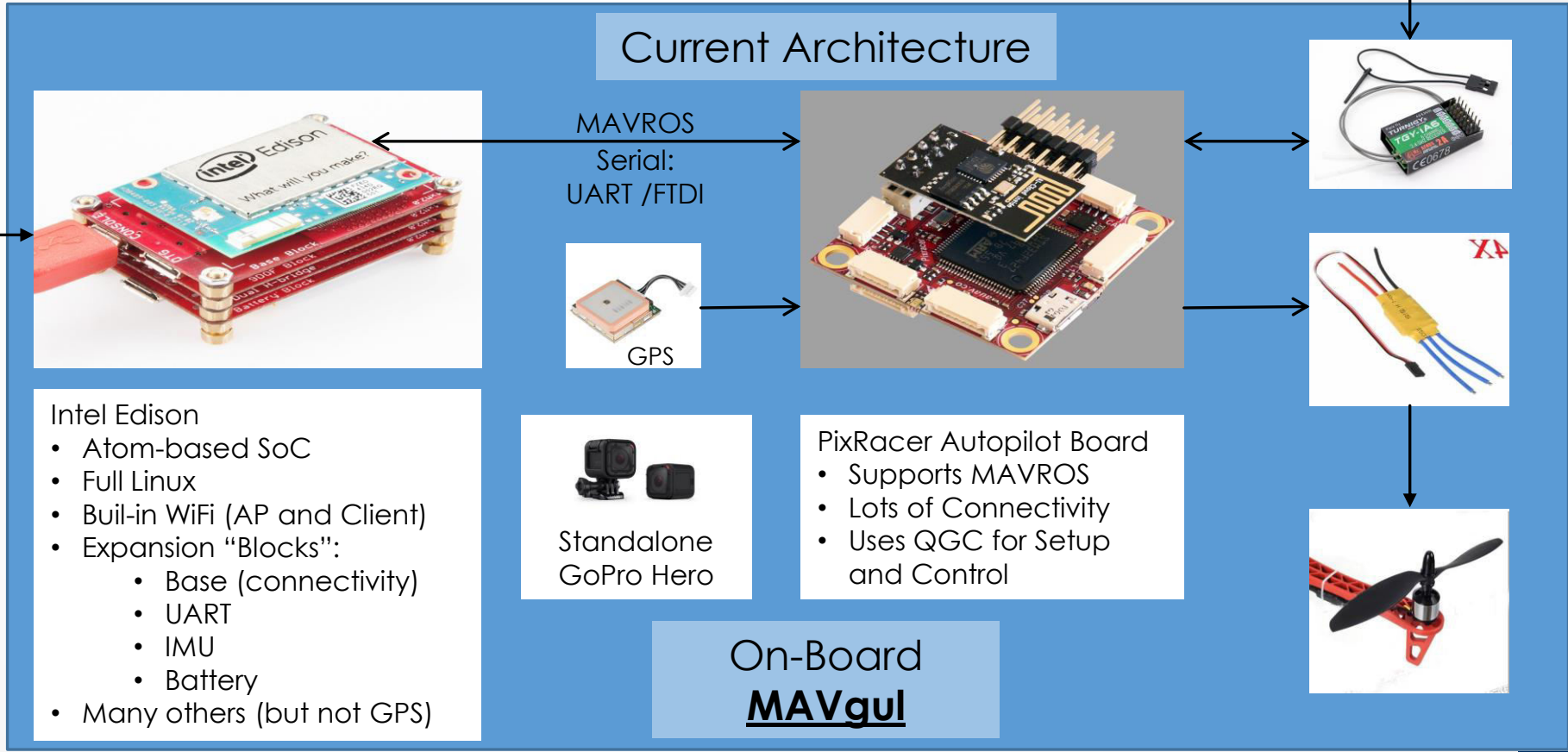
Backup Manual RC



Wi-Fi  
Edison creates MAVGul WiFi AP

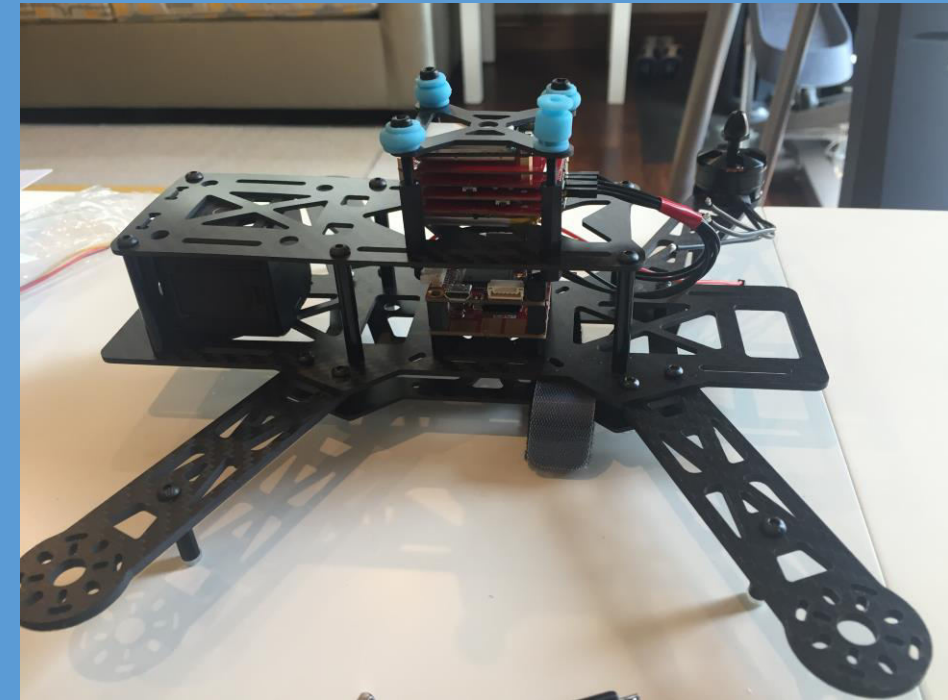
Basic Commands  
GPS Info

Simple Custom App  
Swift  
Xcode IDE



# Results

- Completed
  - Basic iOS Swift app
  - Phone <-> MAVgul WiFi connectivity
  - Basic Edison C Programming done
    - Socket listener
    - UART interface
    - MAVROS Interface
  - Pixracer autopilot configured using QGC
- Currently working on
  - Edison <-> Pixracer connectivity
    - UART Serial to Telem2
  - Adding backup RC connection
- Next Steps
  - GPS integration (iOS and Pix4 <-> Edison)
  - Fly!
- Summer Improvements
  - Replace Hero with FPV connected camera



- LHI Emax 250mm CF Frame
- Simonk 12A ESC
- MT2204 2300KV Motor
- 6030 CF Propellers
- 3S 1300 mAh Battery