LVC21-209: 96Boards, Drones & PX4

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Technologies:

Manufacturing:

Overview:

- Purpose of this project:
  - Expand the 96Boards Drone ecosystem now under the 96Board Auto Edition
    - Improve upon our previous attempt with the Aerocore2
  - Offload compute heavy tasks like live mapping and autonomous navigation from the drone controller to an AP+Accel Arm Platform
    - Targeting PX4 FMUv5x as our Drone Control platform
  - Exploring Use Cases for a heterogeneous Drone control and compute platform
    - Realtime 3D Mapping for Search and Rescue.
    - Photogrammetry
    - Live Terrain Point Cloud
    - Extending the platform to terrestrial and aquatic environments

- Target Audience:
  - People interested in expanding the horizon of on-board drone compute capabilities.

What is PX4?

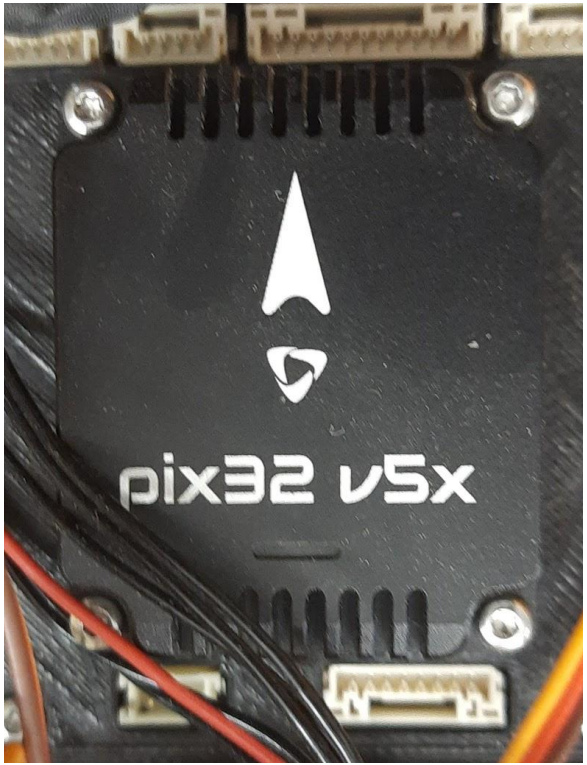
- PX4 is an open source flight control software for drones and other unmanned vehicles.

- Provides a flexible set of tools for drone developers to share technologies to create tailored solutions for drone applications.

- Provides a standard to deliver drone hardware support and software stack, allowing an ecosystem to build and maintain hardware and software in a scalable way.

Meet the PX4 FMU v5x

- CPU:
  - Main: STM32F765
    - 32 Bit Arm® Cortex®-M7 @ 216MHz
    - 2MB memory - 512KB RAM
  - IO Processor: STM32F100
    - 32 Bit Arm® Cortex®-M3 @ 24MHz
    - 8KB SRAM
- On-board sensors
  - Accel/Gyro: ICM-20602
  - Accel/Gyro: BMI088
  - Mag: IST8310
  - Barometer: MS5611
  - ... and more



Initiative Overview

- Basic Goal:
  - Interface Between 96Boards and PX4 SoM/FMU ecosystem
    - Designing and manufacturing development platforms that:
      - Allow the 96Boards and PX4 hardware to communicate with each other
      - Explore both 96Boards CE and SOM platforms
      - Has multiple camera and sensor interfaces.
  - Expose as many I/O as possible between the two modules, even some unconventional ones
    - For example:
      - On-PCB Ethernet
      - On-PCM CAN over SPI

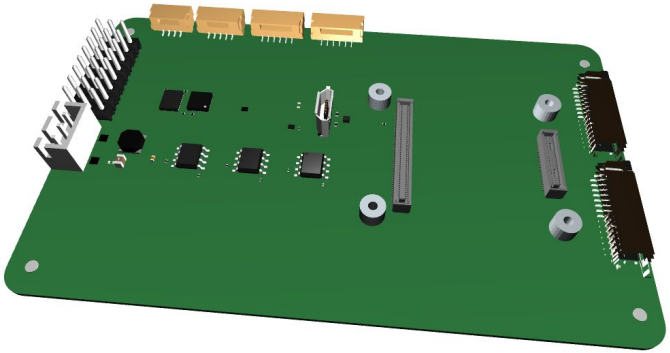
- Extended Goals
  - Optimise firmware and apps for such a compute platform.

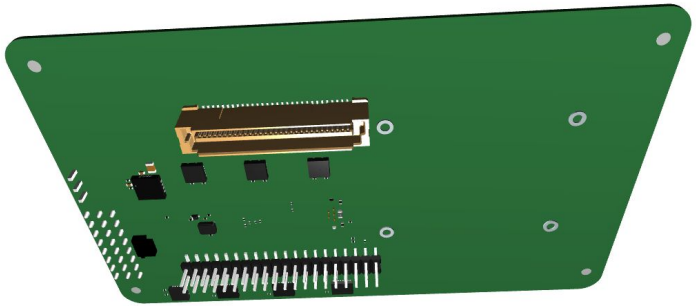
Final Design Decisions:

Tackling two form factors:

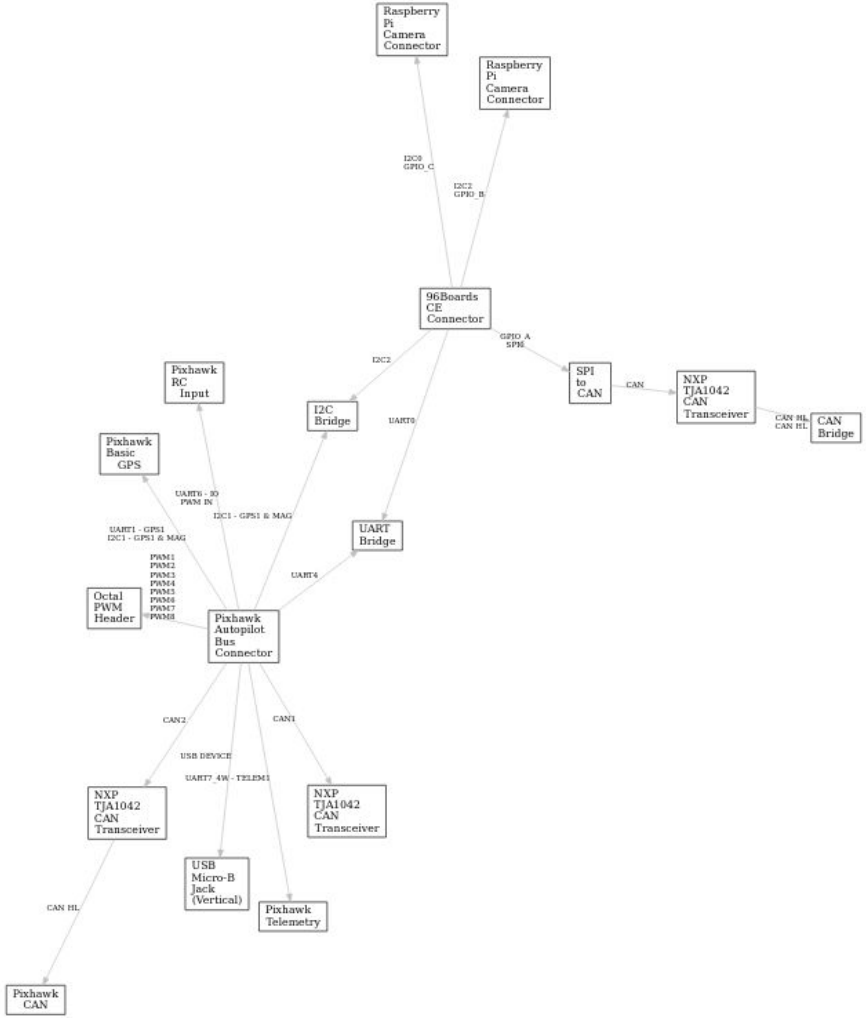
- 96Boards CE Mezzanine:
  - Compatible with Medium Drones:
    - Size: 102mm x 62mm
  - Built to cost (TBD)
    - Limited Interface
  - Compatible with 96Boards CE spec
- 96Boards SoM Baseboard:
  - Compatible with Large Drones
    - Size: 102mm x 70.5mm
    - Made with hexacopters in mind
  - Built to be feature rich
    - All possible interfaces exposed between SOM and FMU
  - Compatible with 96Boards SoM

96Boards FMU v5x Mezzanine

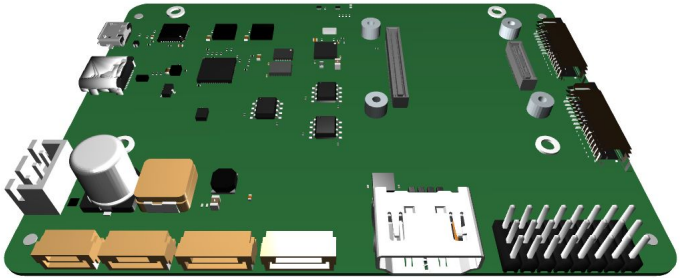


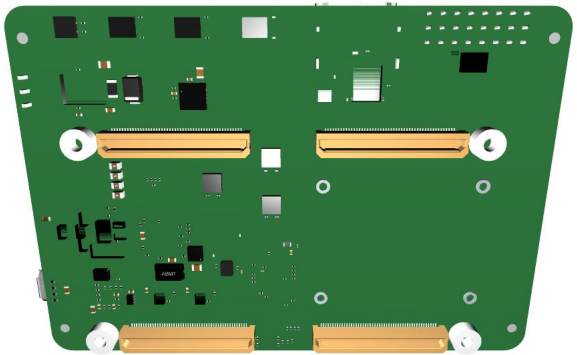


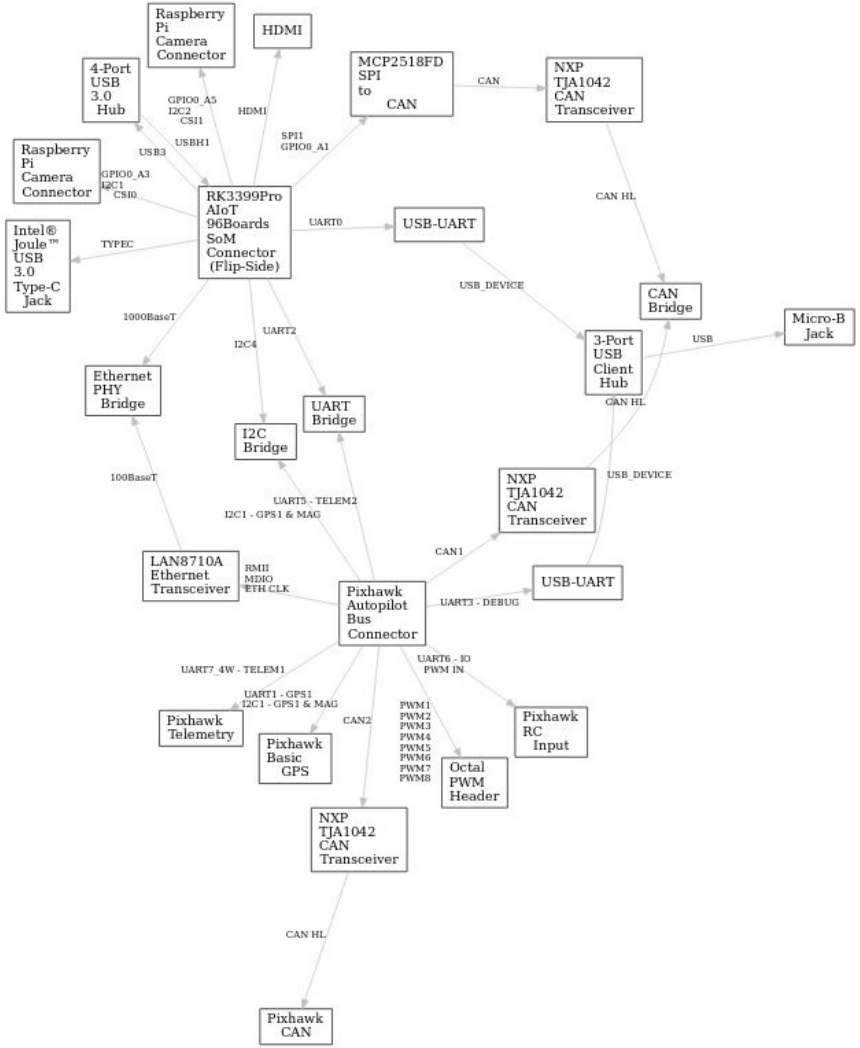
2 Module Connections Graph



96Boards SOM FMU v5x Base-Board







Application Ideas:

- High precision Aerial 3D Mapping and Photogrammetry
- Advanced Image detection and tracking
- Enhanced Autonomous flight and Collision avoidance
- Precision Agriculture Applications
- First Responders and Search & Rescue
- Environmental Monitoring

Resources

- 96Boards: https://www.96boards.org/
- 96Boards Auto Edition (Coming Soon): https://www.96boards.org/products/ae/
- PX4: https://px4.io/
- PX4 V5X and other standards: https://pixhawk.org/standards/
- Gumstix: https://www.gumstix.com/

Thank you

Accelerating deployment in the Arm Ecosystem