LVC21-209: 96Boards, Drones & PX4

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Technologies:

- Boards
- PX4 Autopilot
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
2 Module Connections Graph

96Boards FMU v5x
Mezzanine
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/](https://www.96boards.org/)
- PX4: [https://px4.io/](https://px4.io/)
- PX4 V5X and other standards: [https://pixhawk.org/standards/](https://pixhawk.org/standards/)
- Gumstix: [https://www.gumstix.com/](https://www.gumstix.com/)
Thank you

Accelerating deployment in the Arm Ecosystem