TELEDYNE FLIR

CAPSTONE 2024 CONCEPT

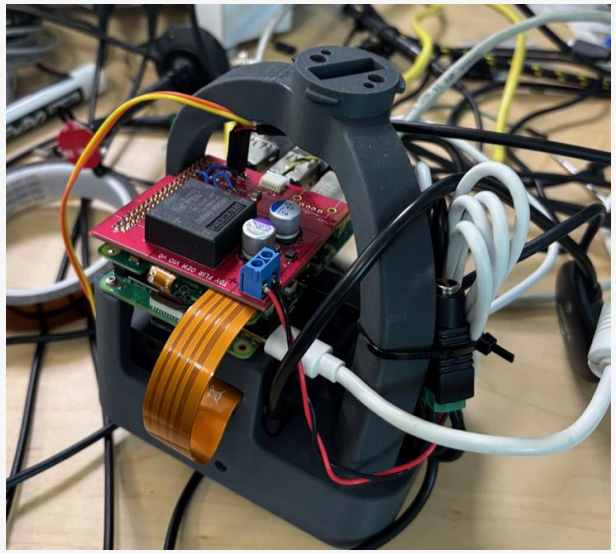
AUGUST 2024

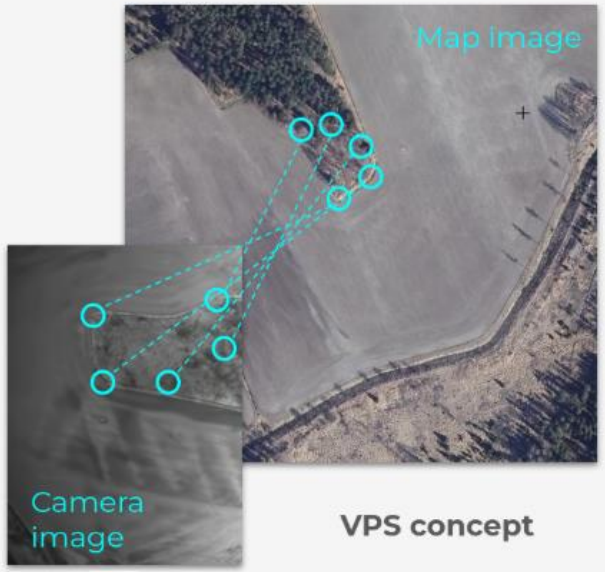
BACKGROUND / PROJECT OVERVIEW

GPS is a critical technology for location determination to execute flight plans however it is being rendered ineffective in certain areas by the practice of jamming GNSS signals

Goal is to develop a package that can use map matching (existing software that Teledyne is developing with an outside supplier) with infrared and visible cameras, and other auxiliary inputs (IMU, altimeter, compass, etc) to maintain accurate location of drone/fixed wing aircrafts in GPS denied environments.

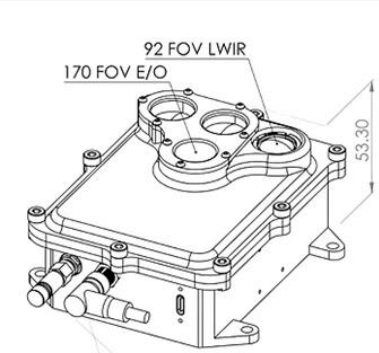
TeledyneFLIR has a very, very rough prototype that we have developed using off the shelf items. We would like this to be redesigned, miniaturized/customized and productized to be used in FPV drones and/or small fixed wing aircraft.





VPS concept

CONCEPT OVERVIEW



Visual Navigation Module

a. Main BOM components
   i. Swapable SOM/carrier board (Raspberry Pi and AVP*) (stretch goal, to be discussed further)*
      1. Create a universal carrier board mounting in moulded part(s)
   ii. >~5 MP Visible monochrome global shutter EO camera with ~140-degree FOV lens and NIR response. Frame rate >90 Hz
   iii. Boson (Boson+?) 640x512 resolution thermal camera with 95-degree FOV
      1. Boson delete for low cost visible only model with covert plug for maintaining IP rating
   iv. 6-axis IMU
   v. Barometer
   vi. Compass
   vii. Altimeter (~<50 meter range) subject to trade study and customer feedback)
   viii. <120 grams
b. Computational Imaging features
   i. Optical flow, IMU and sensor processing
   ii. Map matching referencing drift compensation
a. Standard features
   i. Interfaces over USB and TBD
b. Cost

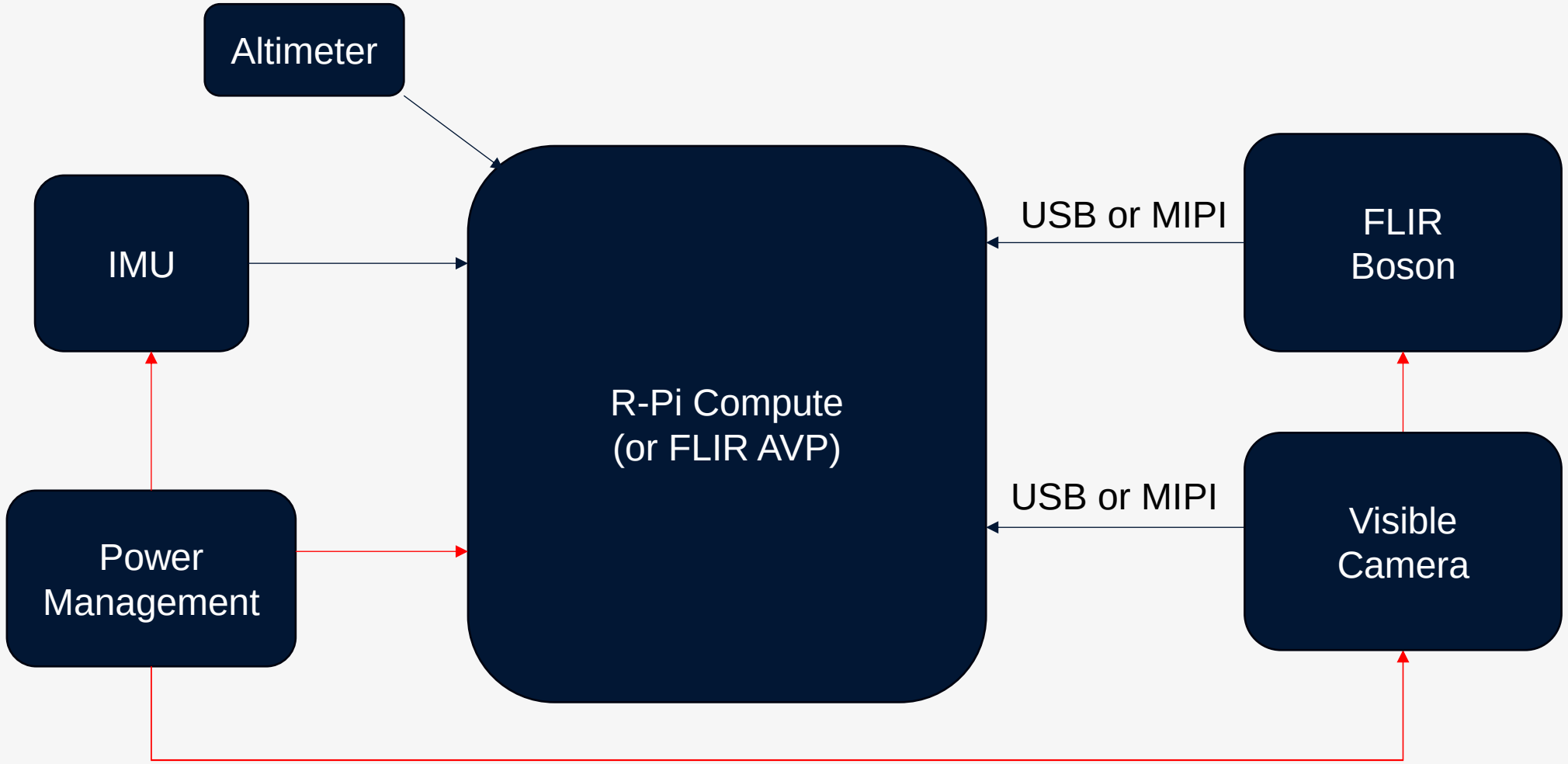
   BOM cost of less than $1000 including Boson 640 w 95 FOV lens
c. Mechanical design
   i. Vibration isolation of camera/IMU module.
   ii. Vibration isolation of module housing and airframe
   iii. Housing material – TBD
   iv. Incorporate Teledyne FLIR industrial design elements
      1. Housing Color
      2. Aperture legends
      3. Hadron housing design queues
d. Environmental
   i. Operating temperature -30 to 70 C
   ii. Shock and Vibration: TBD
   iii. IP-56 (could go down to 54 with customer feedback)
e. Power
   i. 12-36VDC

Power consumption not to exceed XX

DESIGN WORK

- Thermal simulations
- Configuration management
- Swappable Carrier Boards Design
- Vibration isolation of IMU for VISNAV simulations
- IMU coupling to cameras
- Camera synchronization
- Flow simulations
- Condense the prototype hardware into an interface card for the Raspberry Pi Compute Module
- PCB Design must conform to standard R-Pi connectors and not exceed the XY dimensions of the R
- Low-Noise Analog design considerations to be considered due to sensitive sensor input
- Mixed signal PCB design trades
- Embedded R-Pi SW with use of third-party SDK for VISNAV
- Power Management optimization for extended flight time
- Modular interface connections for multiple drone configurations and communication (GOAL)
- Capability to integrate sensor interface card from the R-Pi Compute or the FLIR AVP (GOAL, no need to design secondary card, just design consideration)
- Trade Studies:
    - Vibration of different drones / fixed wing aircraft
    - Mounting configurations of FPV drones and fixed winged aircraft
    - IMU, altimeter, EO camera selection for size, comm/interfacing
- Industrial design concepts

SIMPLIFIED BLOCK DIAGRAM



ACCEPTANCE CRITERIA

Complete a TBD flight between specified locations with capstone designed system tracking predicted GPS location. This flight will include a GPS to determine true flight path. An error of XX throughout flight must be maintained.