

Unmanned Aircraft Networks

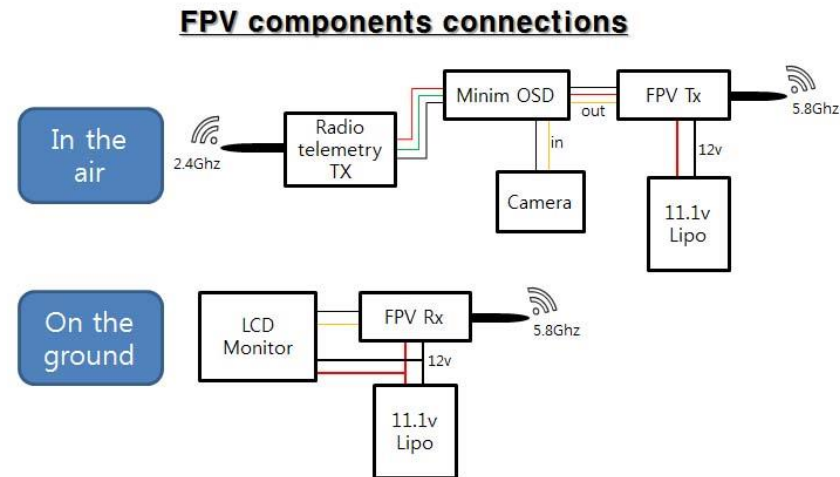
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- **Non-line-of-sight NLOS functionality in urban spaces.**
- **Necessary communication infrastructure**
- **Network resource management.**
- **Air Interface.**

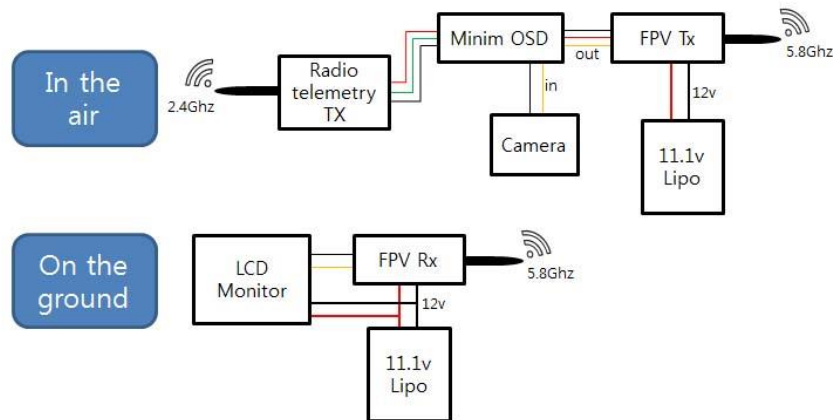
- ***Applied research assistance at SAIT.***

- **Non-line-of-sight NLOS functionality in urban spaces.**
 - Applications like traffic monitoring, sports events will require complete fly-by-wire capability.
 - Operators will be more ‘cameraman’ than pilot and operations will enslave to the application



- **Non-line-of-sight NLOS functionality in urban spaces.**
 - Path planning to avoid collisions.
 - Docking capability.

FPV components connections



- **Necessary communication tiers.**
 - **Regardless of the application, two communication streams must be maintained:**
 - **Critical navigation:**
 - **Geometric: location, path planning**
 - **Identity: aircraft, owner**
 - **system health,**
 - **flight logs etc.**
 - **Non-critical application data, video, other telemetry**

- **Network resource management.**
 - **Space multiplexing is managed in a statistical sense.**
 - **Optimal path versus collision avoidance**
 - **Management algorithms**
 - **Geometric approaches**
 - **Point of closest approach**
 - **Collision cones**
 - **Dubins paths**
 - **Swarms**
 - **Geometric approaches are the simplest for sparse deployments.**

- **Network resource management.**
 - **Management algorithms contd**
 - **Cellular Approach**
 - Discretized airspace
 - » A* Algorithm
 - » Particle filter
 - Requires good heuristics
 - The search space may be confined by allowing onboard path computation.
 - **Mixed Integer Linear Programming**
 - Computationally intensive even for sparse deployments.

- **Network resource management conclusions**
 - **Sparse networks will function on geometric methods**
 - **Prudent research should investigate scalable planning algorithms as networks become more dense.**

- **Air Interface**
 - WiFi
 - Cellular

- **Applied Research Funding Opportunities**
 - **Natural Science and Engineering Research Council of Canada (NSERC) program to:**
 - **Help companies address technology development .**
 - **Expose students to industry problem solving.**
 - **Engage Grants:**
 - **\$25,000.00 available for collaborative research between companies and SAIT.**
 - **Funds administered by SAIT.**
 - **Students are available to assist within group projects.**
 - **Quick return, ~ 4-6 Weeks.**

- **Applied Research Funding Opportunities**
 - **Applied Research and Development Grants level 2 and 3 (ARD2, ARD3).**
 - **\$75K to \$150K per year for up to 3 years.**
 - **At least \$10K cash contribution from company partner plus in-kind to equal half of the total cash value of the grant.**
 - **Used to support student projects and casual labor.**
 - **Often a good vehicle for training new employees.**

- **Applied Research Funding Opportunities**
 - **Innovation Enhancement (IE) Grant**
 - **Funding into \$10⁶s over 5 years.**
 - **Establishment of a research center within the hosting institution.**
 - **Involve several companies (5 -10) within a technology area, each, hopefully but not necessarily, contributing ~ \$35K.**
 - **Generally involves a focus group consisting of SAIT and industry participants.**

- **Applied Research in Unmanned Aerial Vehicles**
 - **ARD2 Grant with 4Front Robotics.**
 - Airframe improvements.
 - Auto-pilot development.
 - Minimization of power consumption.

 - **Student Capstone**
 - UAV web interface for NLOS flights.
 - Focus of research to enable applications.

- **Applied Research in Unmanned Aerial Vehicles**
 - **New IE Grant Application (Cont'd)**
 - **\$2.5M over 5 years to develop a research center.**
 - **Focus of research to enable applications.**
 - **Development of common system components.**
 - **Network infrastructure for large scale UAV operations.**
 - **Testing frameworks for UAV auto-pilot.**

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