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UAV Downlink Suite – Specifications

Introduction

The purpose of this document is to outline the specifications for the Pixel Hawk UAV Datalink Suite. The suite aims to provide seamless and reliable communication between unmanned aerial vehicles (UAVs) and the ground control station (GCS) or Ground control location (GCL). This document will cover the key features, system requirements, and technical specifications of the UAV Datalink Suite.

System Overview

The UAV Datalink Suite will consist of the following components:

a. **UAV Transmitter:** Mounted on the UAV, this device will transmit telemetry, sensor data, and video feed to the ground control station.

b. **Ground Control Station**: A software application installed on a computer or tablet that receives and processes data from the UAV transmitter.

c. **Communication Infrastructure**: The necessary hardware and software components to establish a reliable data link between the UAV and the ground control station.

Key Features

The UAV Datalink Suite shall include the following features:

a. **Real-time Telemetry**: The suite should provide real-time telemetry data such signal and stream status. It provide license information.

b. **Video Feed**: The suite should enable live video streaming from the UAV's onboard camera to the ground control station or (Pixel Hawk UAV DS app) this will be available on Android and Windows. SSL handshake between UAV DS and app required.

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c. **Sensor Data**: The suite should support the transmission of sensor data from any additional onboard sensors, such as thermal cameras or LiDAR. **Only visual data.**

d. **Encryption and Security**: The suite should implement robust encryption and security protocols to protect the data transmitted between the UAV and the ground control station.

e. **Range and Reliability**: The suite should be designed to provide reliable communication over a significant range, with minimal signal interference and low latency.

f. System "Proxy or Catcher" designed to provide added security allowing data to transition from point to point via proxy breaking the direct connection and securing data. Rather than allowing a protocol exchange directly between System A and System B, we insert a "Catcher", often referred to as a proxy (C in the diagram). To System A, the Catcher looks like it is System B. So System A communicates with the Catcher quite happily. System A (drone) System B (Control room) System C (Pixel Hawk Stream server manager).

System Requirements

a. **UAV Transmitter**:

Compatibility: The transmitter is compatible with various UAV models commonly used by majority of emergency services such as DJI, Autel and Parrot.

Power Consumption: The transmitter should have low power consumption to maximize flight time. UAV DS uses 12v directly connected to vehicle socket preferably.

Weight and Size: The transmitter should be lightweight and compact to minimize the impact on UAV performance. Lightweight carry case with shoulder strap weatherproof IP67 rated.

Case Specs:

Dimensions: L358 x W243 x H132mm

- IP67 Rated - Watertight, Airtight and Dustproof
- Pressure Equalization Valve - Adjust internal air pressure
- Chemical Resistant and Anti-Corrosive
- Able to withstand immersion in water up to 1m for up to 30 minutes
- Temperature Range from -20 degrees C to 60 degrees C (Short Term use from -40 degrees C to 80 degrees C)
- Egg Foam Lid Insert for Case Lid
- Foldable Carry Handle
- Strong Steel Pin Hinge Design

Antenna: An omnidirectional antenna with high gain should be used for improved signal reception and transmission. UAV DS has static small stick aerials or optional extendable wired aerials with magnetic bases for attaching to local vehicle body to gain boosted signal quality.

b. **Ground Control Station**:

Operating System: The software application should be compatible with Windows, macOS, and Linux operating systems.

User Interface: The ground control station should have an intuitive and user-friendly interface for easy control and monitoring of the UAV.

Data Processing: The software should be capable of processing and displaying telemetry, sensor data, and video feed in real-time.

Alerts and Warnings: The ground control station should provide visual and audible alerts for critical events such as low battery or signal loss.

c. Communication Infrastructure:

Data Link: The suite will support reliable communication protocols such as Wi-Fi, radio frequency (RF), or cellular networks, depending on the operational requirements.

Range: The suite should provide a range suitable for the intended UAV operations, with consideration for line-of-sight limitations and regulatory requirements. As there is no control element only visual data transmission the necessary data transmission protocols are set to fulfil

this need only. Range is currently tested up to 90 meters from UAV DS and Pilot.

Redundancy: The suite should incorporate redundancy mechanisms to ensure uninterrupted communication in case of link failure or interference. Optional upgrade for slightly larger box will include battery powerpack and charging unit with external display for battery voltage with warning sounds to alert user on low battery levels or battery faults.

Technical Specifications

The following technical specifications should be considered during the development of the UAV **Datalink Suite**:

a. **Data Transmission Rate**: The suite provides data over see below;
b. Specs follow:
c. Bandwidth Downlink data: 5G/NR sub-6: 2Gbps-10Gbps, LTE 2.4Gbps
   Uplink data: 5G/NR sub-6:2.5Gbps, LTE 450Mbps
d. Wi-Fi (WLAN)
   Wi-Fi 802.11a/b/g/n;
e. Frequency Range:
   2.4Ghz: 2.412 ~ 2.472Ghz
   5Ghz Band 1: 5150~5250MHz
   5Ghz Band 4: 5475~5850MHz
f. Speed:
   802.11n in 300Mbps;

b. **Video Resolution:** The suite should be capable of transmitting high-definition video (e.g., 1080p) for improved situational awareness. UAV DS is programed to manage and stream the original resolution and bitrate as well as any audio codecs to provide the best possible visual transmission.

c. **Latency**: The latency between the UAV and the ground control station should be minimized to enable responsive control and accurate data monitoring. Zero buffering has been created to allow for the best low latency possible. Circumstances on signal and location as well as distance of pilot from UAV DS may cause difference in latency. (tested from 10 meters with 1.5 seconds latency.)

d. **Encryption**: The suite should utilize industry-standard encryption algorithms to protect data integrity and prevent unauthorized access. Main stream server providing 256 AES encryption, no data recordings stored on system, Wi-Fi provides WPA2 PSK AES 128 encryption data transfer and IP sec over 5G.

e. **Antenna Performance:** The antenna system should have high gain, low signal loss, and good resistance to interference to ensure reliable communication. Standard stick ariel and extendable mag mount ariel for longer range high gain provided.

Conclusion

The UAV Datalink Suite developed for Pixel Hawk Ltd will provide a comprehensive communication solution for their unmanned aerial vehicles. By incorporating features such as real-time telemetry, video feed, and robust encryption, the suite aims to enhance the operational capabilities and data security of the UAV system. The system requirements and technical specifications outlined in this document will serve as the basis for the development and implementation of the UAV Datalink Suite.