MRD5165 Platform
User Guide - Demo Apps

Revision History

Revision	Date	Description
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1. Introduction

The MRD5165 platforms (Eagle – Kit & Edge AI – Box) from Mistral are compact, high-performance edge AI Engine built around the Qualcomm QRB5165 SoC, providing 15 TOPS (Trillion Operations Per Second) of artificial intelligence (AI) performance. This enables efficient processing of complex AI and deep learning workloads for on-device edge inferencing. It is designed to deliver high-speed wireless connectivity and high-accuracy AI and machine-learning inferencing technology, accelerating the development of innovative, power-efficient, high-computing robots for enterprise, industrial, and professional service applications.

Packed with cutting-edge technology, this kit empowers developers to create powerful drone solutions. Experience exceptional compute performance, seamless AI integration, and precision with computer vision capabilities.

The MRD5165 platforms include MRD5165 SoM, the core of the Edge AI Box, is a high-compute, AI-enabled, low-power processor with 8GB LPDDR5 PoP memory, 128GB UFS storage, a dedicated high-performance Computer Vision Engine for video analytics, on-board wireless connectivity, and multiple PMICs for power supplies. The MRD5165 platform integrates a powerful Image Signal Processor and provides various peripheral connections such as 6 MIPI CSI cameras, an HDMI Camera, USB 3.0 ports, a Micro USB port for debugging, and a Gigabit Ethernet port for wired connectivity. It also integrates an expandable SD card slot for additional storage.

The MRD5165 Eagle Kit from Mistral is an advanced drone controller built around the Qualcomm QRB5165 SoC and CubePilot's Cube Orange+. Designed with power efficiency in mind, it ensures longer flight times without compromising performance. Explore the skies and revolutionize the drone industry with our optimized development kit – your gateway to a new era of airborne innovation. The MRD5165 Eagle kit delivers high-speed wireless connectivity and high-accuracy artificial intelligence (AI) and machine-learning inferencing technology to facilitate accelerated development of innovative, power-efficient, high-computing robots and drones for enterprise, industrial, and professional service applications.

The MRD5165 Edge AI – box is highly integrated, modular form-factor design tailored for robotics developers, drone manufacturers, and system integrators, empowering users to build intelligent machines customized to their requirements. The kit is meticulously engineered for effortless integration directly into your designs!

This MRD5165 platform also includes multiple software options including support for embedded Linux and a reference Root File-System from Ubuntu. The kit supports Linux Kernel 5.4, Ubuntu, and ROS; and includes a suite of software packages for implementing various applications such as AI/ML, Neural Processing, Auto Pilot, Navigation, Machine Vision, Multimedia and User Interface among others.

This document provides the instructions to set up the Eagle-Kit and procedure to exercise the demo applications bundled in the pre-flashed OS image the Eagle Kit. Sections XXXX provides illustrations on the demo applications applicable for both Edge AI-Box as well as Eagle-Kit. Section YYY provides illustrations on the demo applications applicable for Eagle-Kit only.

2. Overview

The Mistral MRD5165 Eagle Kit is based on Qualcomm's QRB5165 processor. The MRD5165 Eagle kit provides a high-performance compute platform for precise artificial intelligence (AI) and machine-learning inferencing technology to facilitate the accelerated development of innovative, power-efficient, high-computing robots and drones for enterprise, industrial, and professional service applications. It offers readily deployable SDKs, Ubuntu Root-FS and tools for product development to facilitate quick prototyping and proof-of-concept evaluations. Additionally, this kit includes high performance connectivity interfaces making it an ideal platform for connected Eagle device in IOT, Drones and Robotics.

Both MRD5165 Eagle-Kit as well as MRD5165 Edge AI-Box provide multiple connectivity options and peripherals/sensor interconnects.

Below images provide illustrations of various possible configurations for Edge – AI box and Eagle Kit.
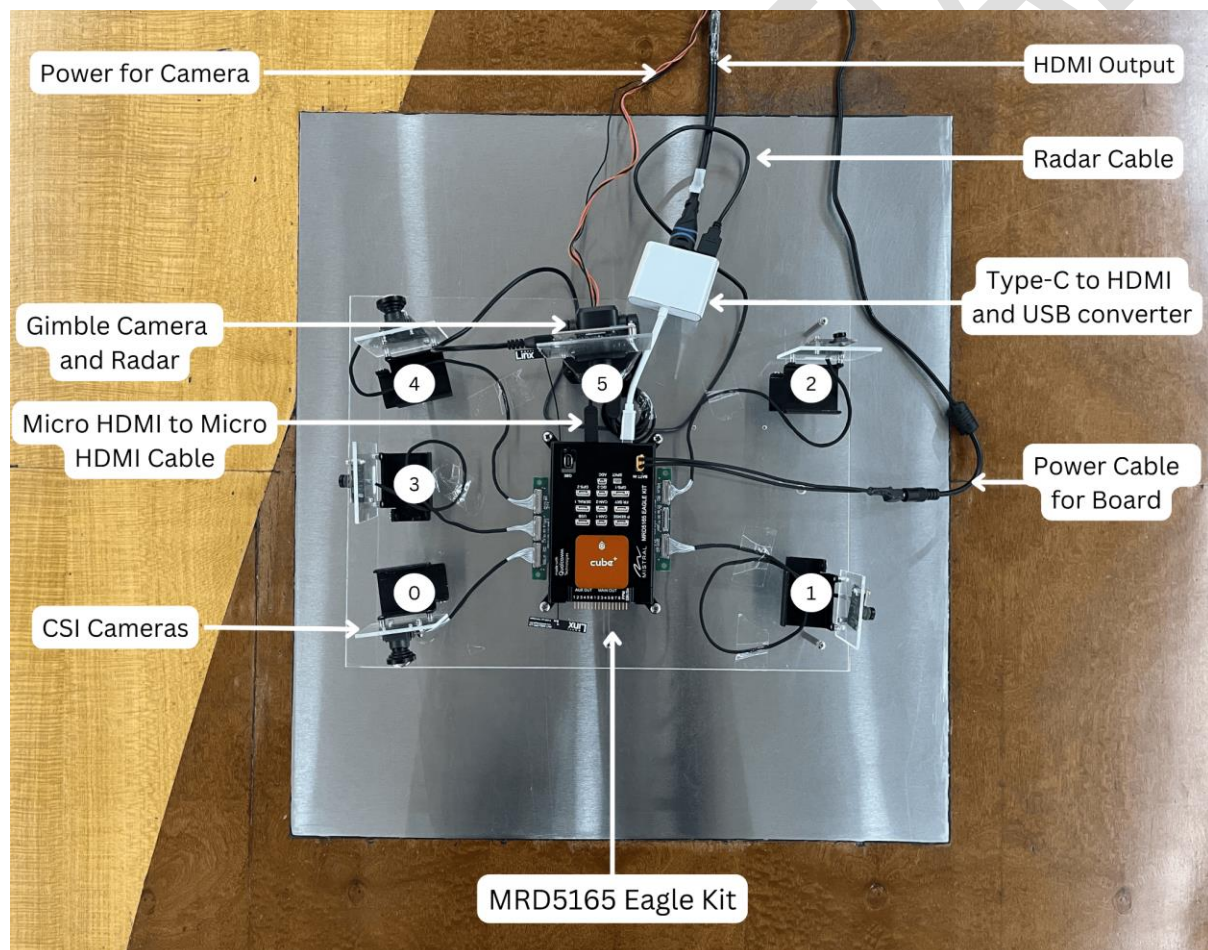

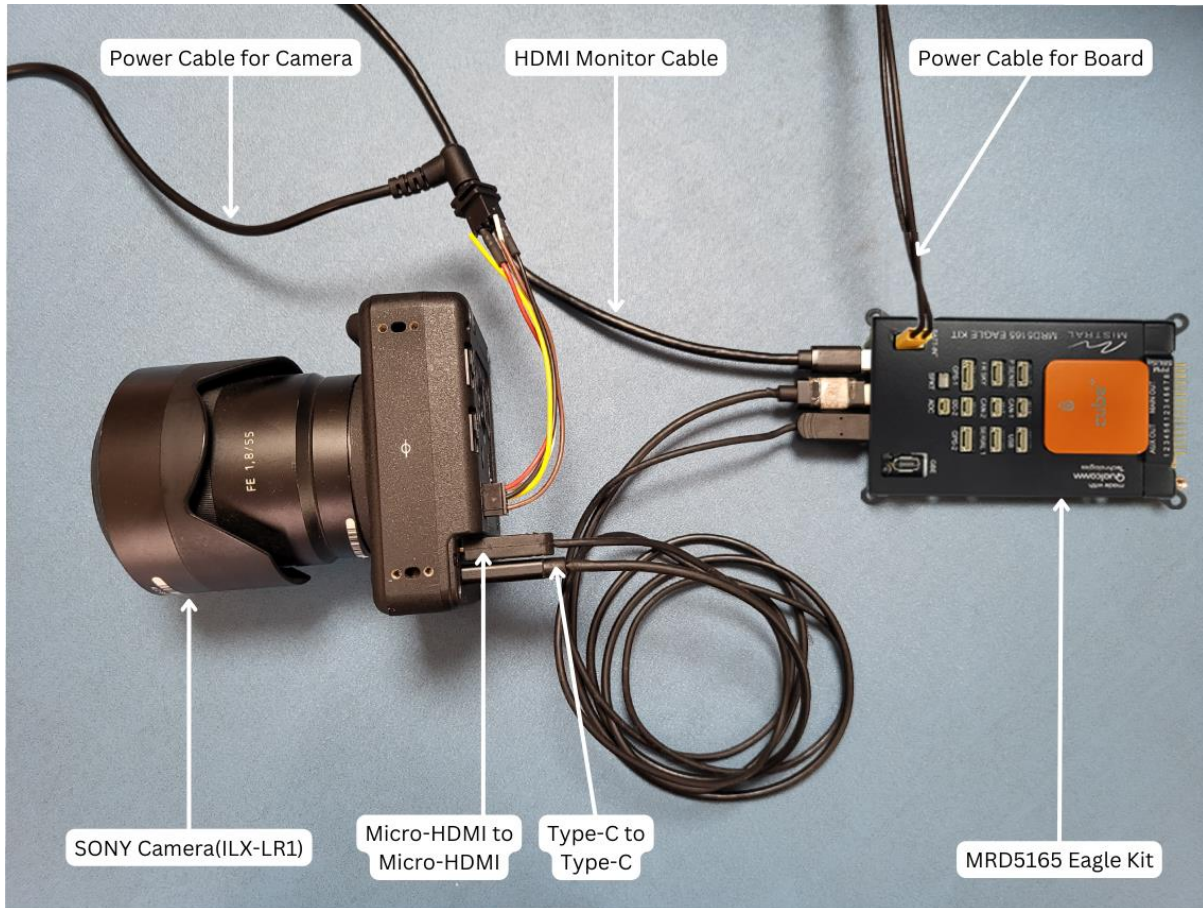*Figure 1: MRD5165 Eagle kit with Radar and Gimble Camera*

Figure 2: MRD5165 Eagle kit with Sony camera

Both the platforms come with pre-flashed OS image including the demo applications that can be exercised using the embedded Web-server (Rpanion Server). Rpanion-Server is a software package providing a web-based interface for

- Configuring the network,
- Telemetry (MAVLink) routing,
- Logging from a connected flight controller,
- Sony ILX-LR1 camera control and preview,
- RTSP and RTP streaming, webRTC streaming / Preview

3. Getting Started

After making the required connections (refer section 1), on power up, the platform boots up to

- Display a pattern on the monitor connected to the USB Type-C
- Host a Wireless Access-point with SSID "Eagle-Kit XXXX ", where XXXX would be replaced with the board serial number. The password for this network is "1234567890 " without quotes .
- Launch the Rpanion Web server

For connecting to the web server,

- Please connect the PC WLAN to the Access-point SSID "EAGLE-Kit XXXX" with the password "1234567890" (without quotes).
- Using the standard web browser (Microsoft Edge, Google-Chrome or Mozilla Firefox) open the web page by typing the URL http://192.168.2.1:3001

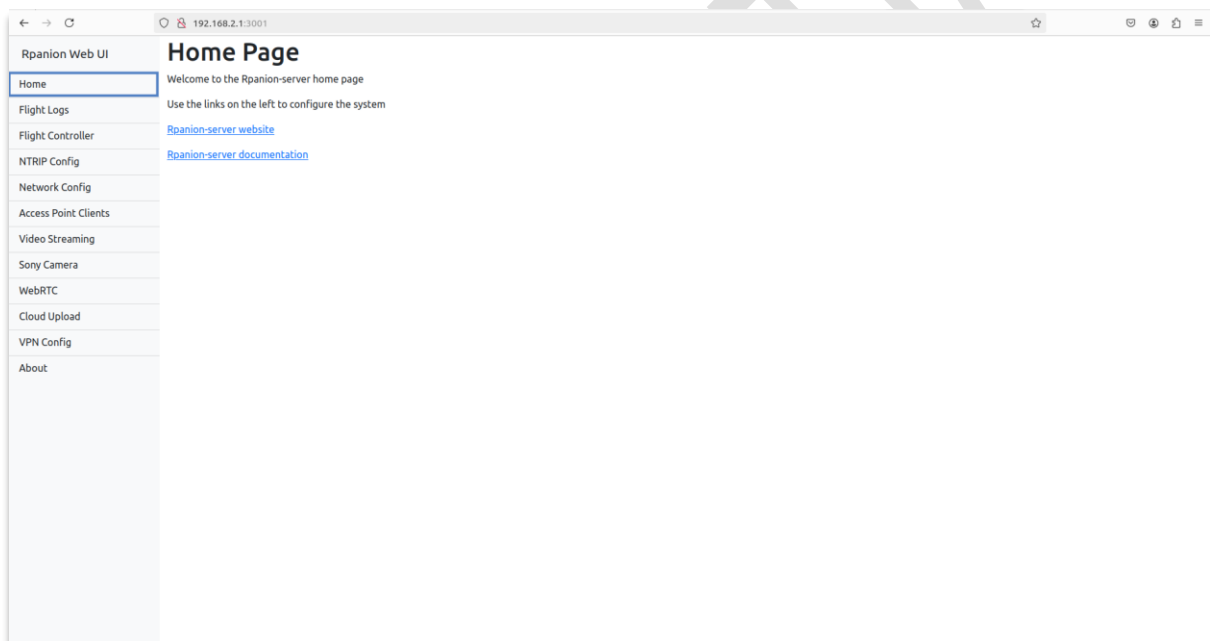The Rpanion server home page gets displayed as below.

Figure 3: Rpanion Server Home page

4. Edge AI – Box & Eagle-Kit features

4.1. Web-RTC Video streaming

The Web-RTC is the video streaming protocol that enables the Web-browser to receive the video stream and display with minimal latencies. This is typically used for the video conferencing applications.

On the MRD5165 platform, the Web-RTC is integrated to support streaming the video data from camera. Both native video stream from camera or advanced one with live annotations is supported.

The Web-RTC page controls the ability to start/stop streaming the video from the HDMI Camera using the Web-RTC protocols. The preview of this video stream can be seen in the Browser application and does not require any other media player application.
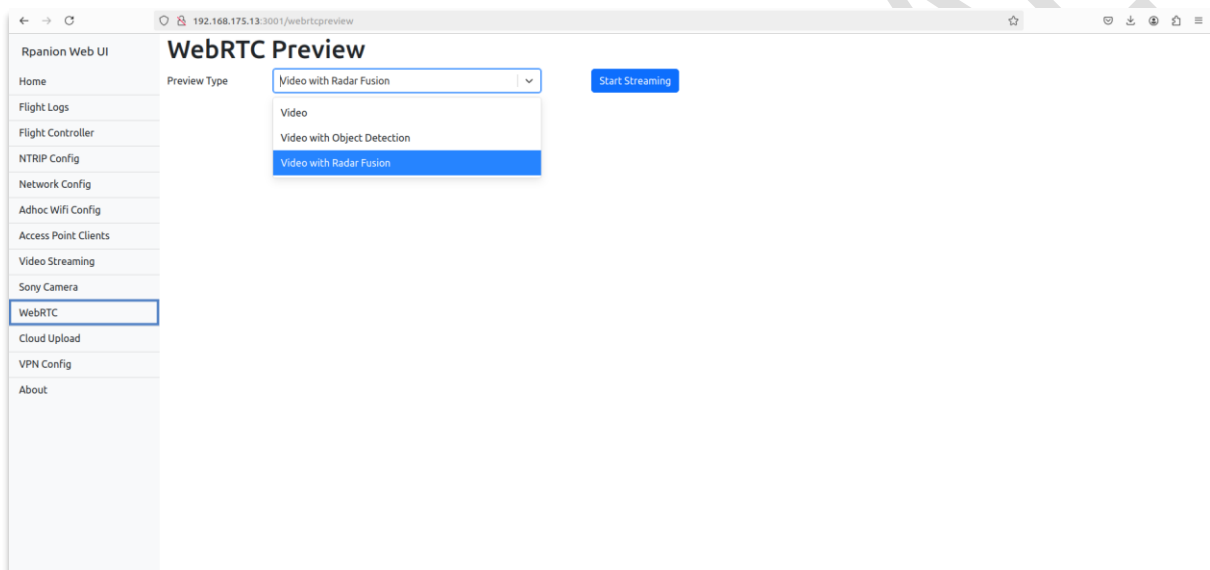
Figure 4: Web-RTC UI

This page offers the streaming of the below type of video.

- Only Video from the HDMI camera connected to the HDMI Input port.
- Video along with the object detection from the HDMI camera connected to the HDMI Input port.
- Fusion Video stream having identified objects along with the estimated distance using RADAR on the Video from the HDMI camera connected to the HDMI Input port.

For enabling the Web-RTC streaming, select the desired video option and click on the Start Streaming button. The video playback shall start on the same page subsequently.
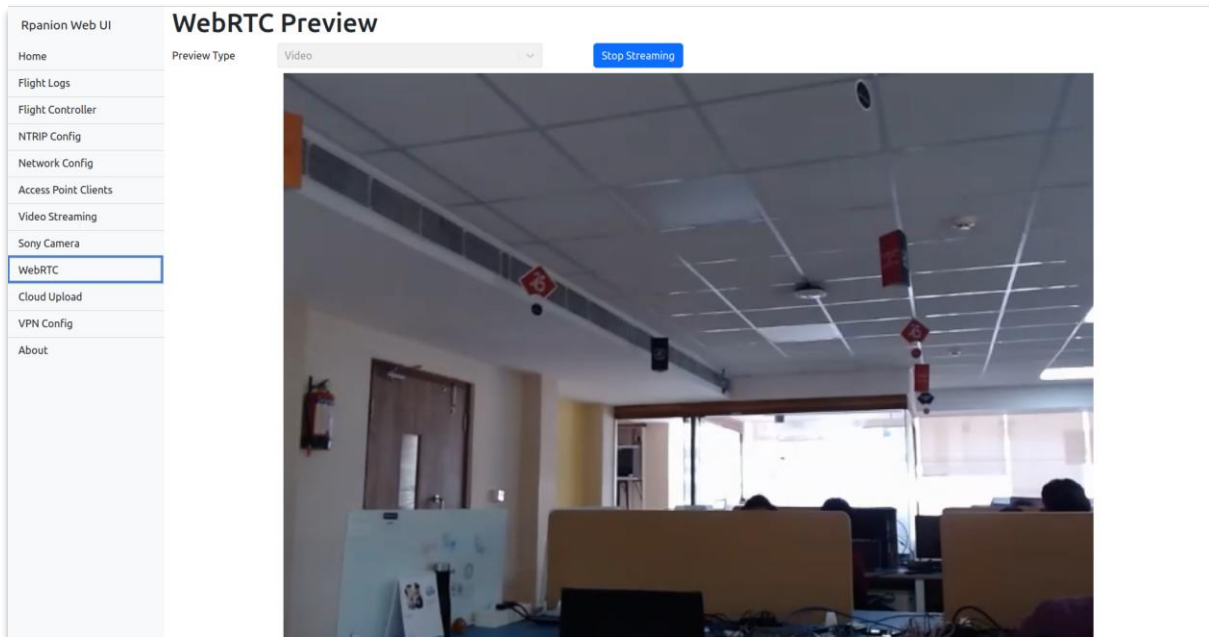
Figure 5: Web-RTC Preview

NOTE**:**

- Before starting radar fusion, please ensure radar and HDMI camera is connected to board
- We can see the preview on the monitor, if the USB Type-C cable is connected to the display / Monitor

- Make sure to set the HDMI camera ID correctly in the `/etc/Rpanion-server-app/Rpanion-server/config.js` file before starting the stream.

- Refer Figure 1 to know camera ID.

4.2. RTP/RTSP Video streaming

RTP/RTSP are the protocols for video streaming. On MRD5165 platform, in addition to Web-RTC, RTP/RTSP is also supported for streaming the video contents. Both native video stream from camera or advanced one with live annotations is supported.

The Video Streaming page controls the ability to stream video from a connected camera to the network via an RTSP or UDP stream. Any supported CSI camera or any standard USB camera could be used on the platform. Rpanion-server uses the GStreamer framework to start an RTSP server and will transmit H.264 compressed video to any connected video clients.
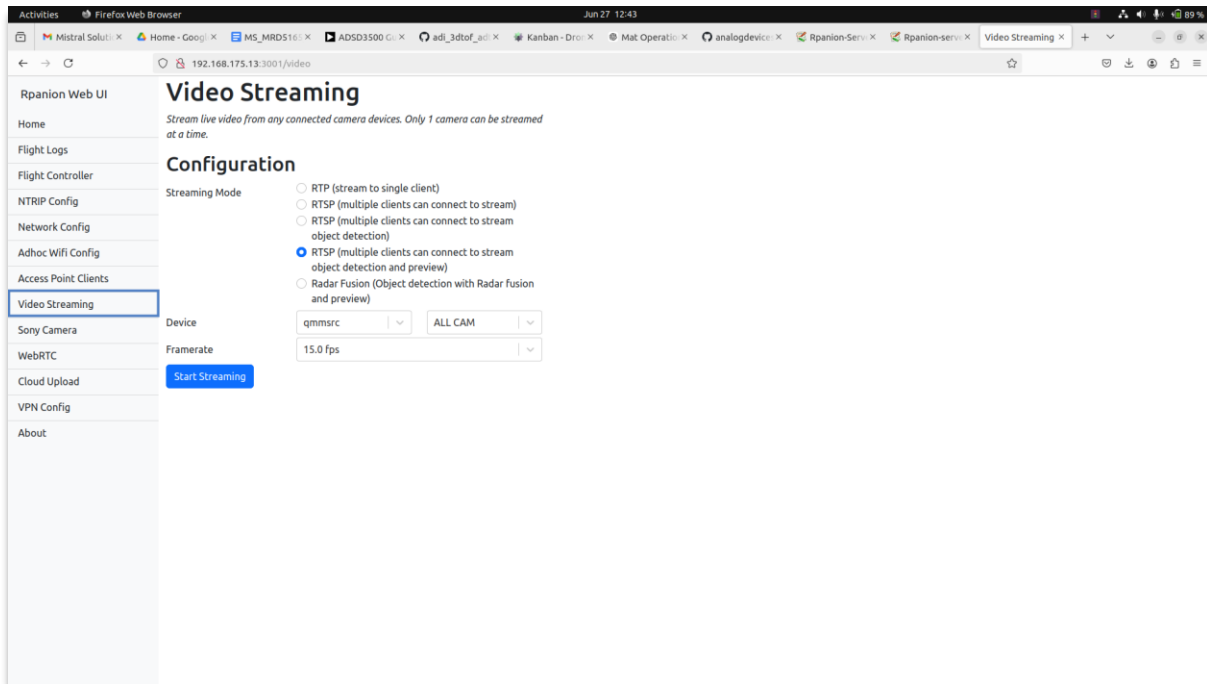
Figure 6: Video Streaming UI

Various types of video streaming use-cases integrated into the Rpanion server web-page is mentioned below:

- RTP stream to a single client
- RTSP Server for native camera (allowing multiple clients to connected and retrieve media stream)
- RTSP Server for camera video with Object detection
- RTSP Server for camera video with Object detection with preview on the HDMI output
- RTSP Server for fusion of RADAR and Camera with object detection with preview on the HDMI output.

In this page, the "Device" can be selected from the drop-down options like HDMI, IMX, OV or ALL_CAM. While selecting ALL_CAM, the video stream would provide a tiled mosaic of 3-camera (Camera ID 0, 1 & 2 in Figure 1) connected to the platform.

For the RTP Stream to single client,

- Select RTP Stream option
- Select Device,
- Enter Destination IP (client IP) and Port for streaming
- Click on "Start Streaming" button
- Open the media player for viewing the RTP Stream
  NOTE: Sample SDP file for playback in the client machine VLC player using SDP file. sdp file should have the following content:

```
v=0

m=video <port> RTP/AVP 96

c=IN IP4 192.168.2.1

a=rtpmap:96 H264/90000
```

For RTSP server (enabling multiple clients to be able to stream video)

- Select RTP Stream option based on the setup and preference
- Select Device
- Click on "Start Streaming" button
- Open the media player for requesting the RTSP Stream.

The sample Gstreamer command for receiving / previewing the same is as below.

gst-launch-1.0 rtspsrc location=rtsp://192.168.2.1:8554/qmmsrc latency=0 buffer-mode=auto ! decodebin ! autovideosink

sync=false

While using the VLC Player the below can be used as the network stream URL.

rtsp://192.168.2.1:8554/qmmsrc)

NOTE:

If VLC is used, there may be up to 2 seconds of video latency. For applications requiring low latency, consider the following options:

- Reduce the "caching" option in VLC: This can help decrease the latency.
- Use GStreamer: GStreamer is another option that may provide lower latency compared to VLC.

- ALL_CAM option will work only if at least 3 cameras are connected

- Make sure to set the camera ID correctly in the `/etc/Rpanion-server-app/Rpanion-server/config.js` file before starting the stream.

4.3.Sony Camera

SONY Industrial camera supports advanced features including image stabilization, high resolution image capture and many other post processing abilities. Sony ILX-LR1 camera also supports digital control over the UART allowing the remote system to adjust the camera settings using the Remote-SDK. The MRD5165 platform includes the Sony Remote-SDK to interact with with Sony ILX-LR1 camera interfaced over the USB connection.

The Sony Camera page enables remote control of the camera and video preview. By default, the preview will display once the page loads. Currently, only the Sony ILX-LR1 is supported by the Rpanion server. Control commands from the board to the camera are transmitted via UART, while the video is sent through HDMI. The page supports zoom, image capture, and video recording operations.

NOTE: It may take a few seconds for the preview to load, especially the first time you access it.

Figure 7: Sony Camera UI

The following operations are supported:

● Zoom Operation
  ○ Zoom level can be increased/decreased using slider (or) Mouse scroll on top of the video region.
  NOTE: Mouse Scroll effect may differ between Touchpad and external USB mouse.

● Capture Image
  ○ Image will be captured On-Click of the Capture Image button. (It may take a few seconds to complete the capture.)
  ○ Captured Image will be displayed at the Gallery section on the same page.
  ○ On-Click of the Images, You can delete and download images.
  NOTE: Image capture will work only when the camera is in Still mode.

● Video Recording
  ○ You can Start/Stop the Video Record using Start/Stop Rec buttons.
  ○ Video Recording will be saved in camera SD-Card only.

NOTE:
● Connect Sony ILX-LR1 camera micro HDMI (for video) and Type-C cable (for controls) to board.
● Keep the sony camera in Still mode
● Browser Caches may affect the loading of the preview. Refresh the tab by pressing Ctrl + Shift + R. (or) Use the browser in private mode.
● The GoLive option will work only in Mozilla FireFox only.
● Make sure to set the HDMI camera ID correctly in the `/etc/Rpanion-server-app/Rpanion-server/config.js` file and refresh the page.
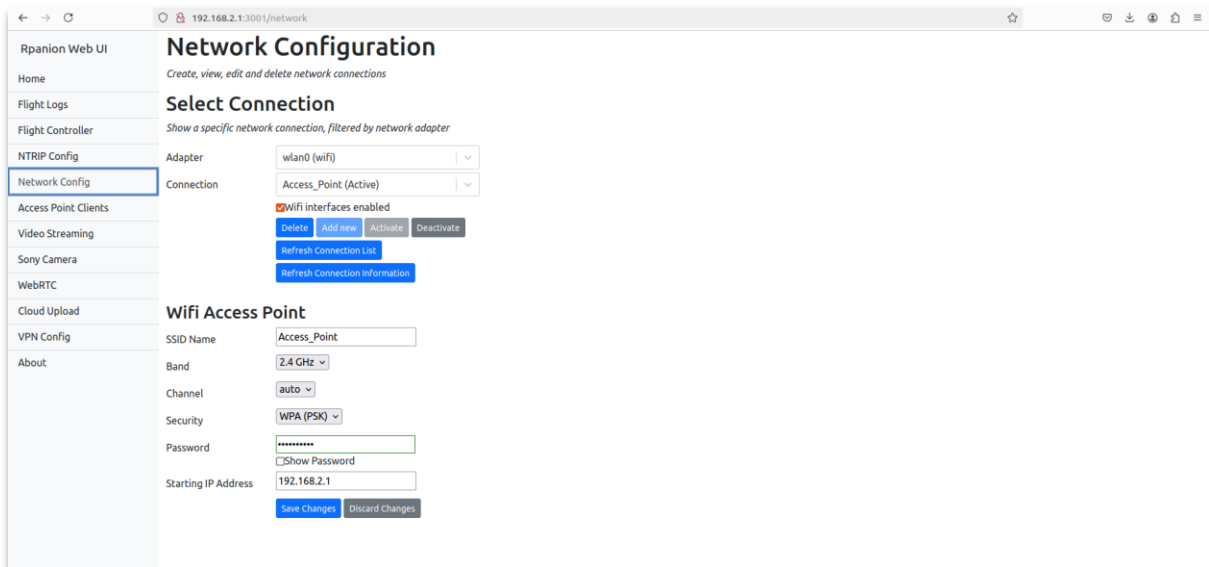
4.4. Network configuration

Figure 8: Network Config UI

The Network page allows the computer's network settings to be viewed and changed. This includes both Wi-Fi and wired (Ethernet) based connections.

Network management is done on an adaptor (hardware device) and connection (collection of network settings) basis. Each adaptor can have one connection active at a time.

Connections for an adaptor can be added, edited or deleted via the named buttons. When adding Wi-Fi connections, a list of available networks will be shown. Click on the desired Wi-Fi network on the list to pre-fill its details.

Settings are saved between reboots.

If debugging of network settings is required, the "nmcli" tool can be used for checking the connections.

To disable all Wi-Fi interfaces (also known as Flight Mode), toggle the "Wi-Fi Interfaces Enabled" button. When disabled, the Wi-Fi connections will not be able to be edited. To edit network configurations like switching from AP to wifi, you can use `/etc/init.d/start_netwotk.sh` file.

NOTE: If we are changing connection details, we might lose connectivity with the board, need to establish connection again and reload the page.
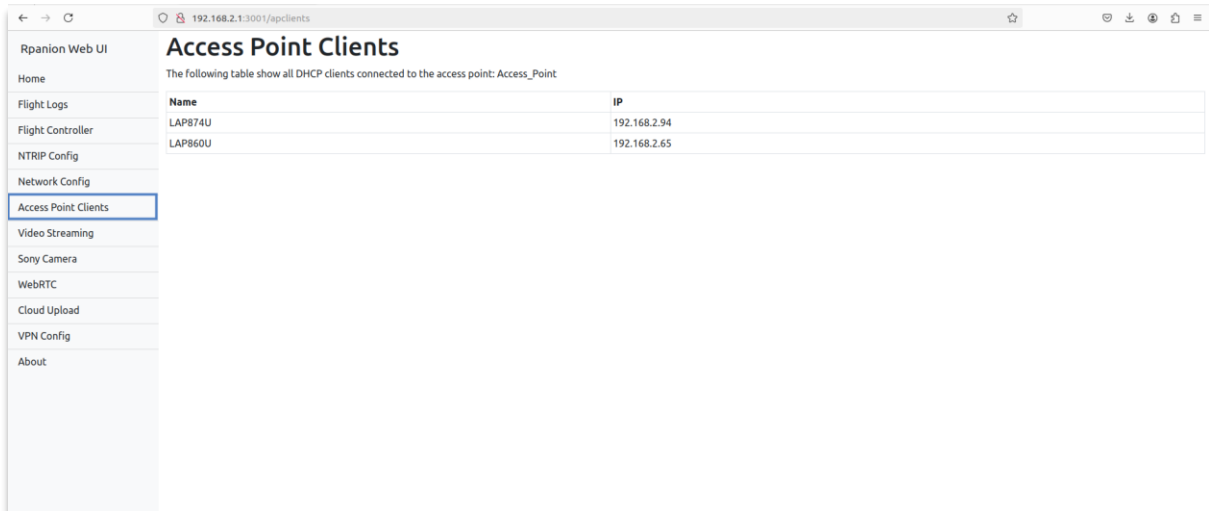
Figure 9: Access Point connected Clients list

If a wireless adapter on the companion computer is configured to be an AP (Access point), this page will show the name and IP address of all connected clients.

4.5. VPN configuration

The OS image includes the options to configure the VPN for enabling the remote connectivity across the Public internet connection. The Zerotier VPN services are being utilized for this purpose. The page "VPN Config" enables users to provide the required provisioning information for successful connectivity.
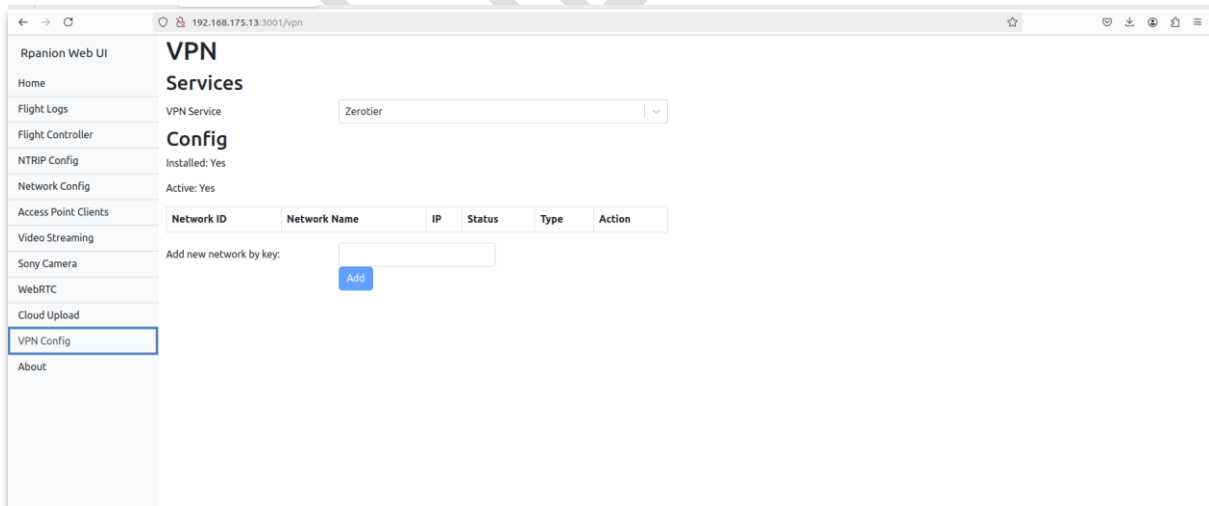

Figure 10: VPN Config UI

To create your own Network ID can refer to the page my.zerotier.com.

After creating a network in zerotier, add network ID on board using the UI and get the IP address.

Install and join Zerotier network in PC using below commands:

```
curl -s https://install.zerotier.com | bash

systemctl start zerotier-one

systemctl status zerotier-one

sudo zerotier-cli join <network-id>

ping <ip-address for zerotier interface in board>
```

Check the zt* interface to get the active zerotier ip-address in PC

NOTE: Internet connection is required to make zerotier active

5. Eagle-Kit features

MRD5165 platform includes the software infrastructure to relay the Flight data telemetry using its network connections including Wireless LAN or VPN. The VPN could be configured to use the 5G connectivity too.

5.1. Flight Controller data telemetry

The Flight Controller page controls the telemetry (MAVLink) input and outputs from a connected flight controller. A UDP server is available via the "UDP Server" option. Ground stations can connect to the specified port on all network interfaces.

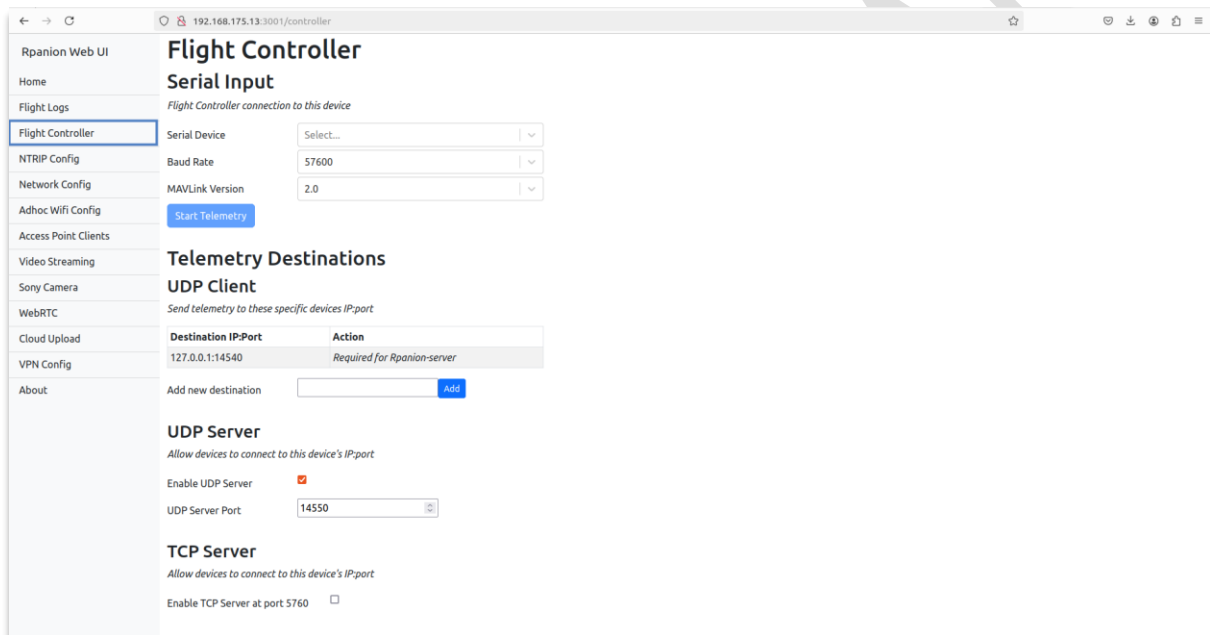NOTE: ttyHS5 is the Orange cube device node

Figure 11: Flight Controller UI

To enable telemetry from a connected flight controller, ensure the correct device, baud rate and MAVLink version are selected, then click the "Start Telemetry" button. If successful, the "Status" section of the page will show incrementing packet numbers, the vehicle type, firmware type, firmware version and connection state.

Any status text (statustext MAVLink message) from the flight controller will be displayed in the text box marked "Console Output".

To forward telemetry across a network via UDP, enter the destination in "IP:port" format in the "Add new output" text box, then click "Add". To stop telemetry, click the "Stop Telemetry" button. This will also allow the connection settings to be changed.

These connection settings persisted in the Flash across reboots.

If desired, telemetry can be output over TCP, using the "Enable TCP Server" option, which will start a TCP server at port 5760 on all network interfaces.
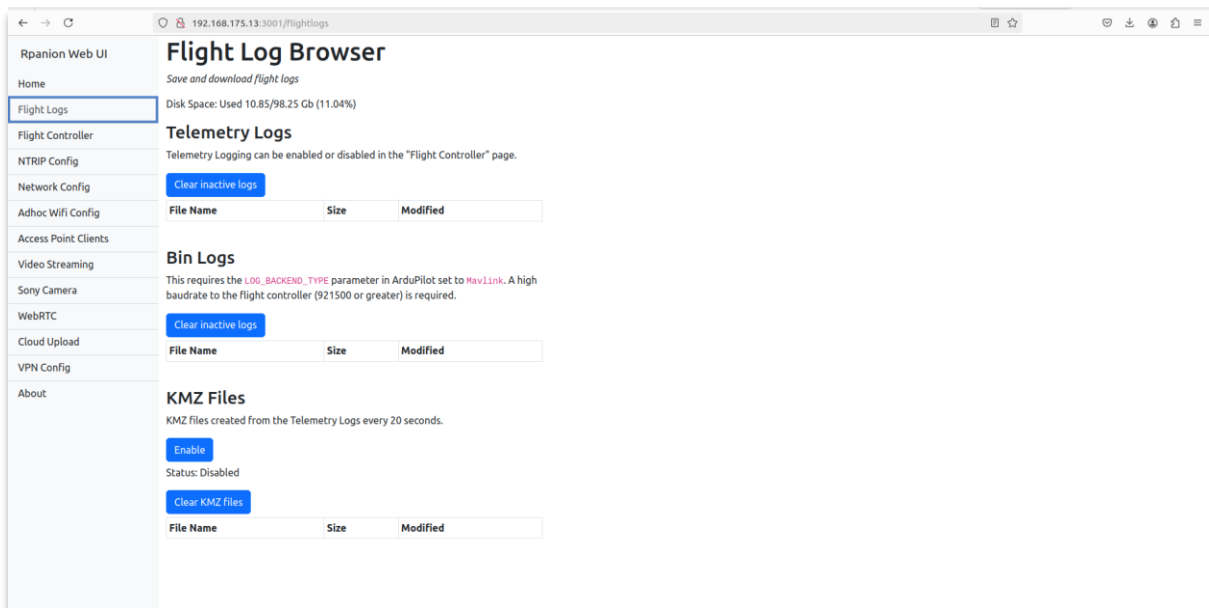
5.2. Flight Controller Logs

Figure 12: Flight Logs UI

While the Flight controller is connected to MRD5165 platform, using Flight Logs page all telemetry logs (tlogs) and data flash (bin) logs can be downloaded.

If logging is enabled (via the checkbox on the page), Rpanion-server will log all received MAVLink packets to a tlog file. These logs can be downloaded via clicking on the log file name in the table.

Dataflash logs will be logged according to the settings on the flight controller. In ArduPilot, set the LOG_BACKEND_TYPE parameter to use "MAVLink" to enable Dataflash logging to Rpanion-server.

Rpanion-server will start a new tlog:

- On boot
- When flight telemetry is started on the Flight Controller page
- When the user clicks the "Start new Logfile" button

A log file can be downloaded via clicking on the log file name.

To delete all inactive (not currently being used for logging) logfiles, click the "Clear inactive logs" button for each log type.

If desired, KMZ (zipped KML) files can be automatically generated from flight logs via the "Enable" button in the "KMZ files" section. The KMZ files are generated every 20 seconds, based upon the available telemetry logs.

6. Additional Assistance

Please contact our support team for further assistance:

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Email : info@mistralsolutions.com

Web : https://mistralsolutions.com/MRD5165

Note: Information contained in this document is subject to change