

FPV Low-cost Pod V3.0

1. Product Overview

The drone tracking system comprises two modules: the gimbal camera assembly and the target recognition and tracking assembly. The gimbal camera module performs visible light imaging and outputs field-of-view angular velocity data. The target recognition and tracking module features autonomous target identification, person-in-loop detection, automatic target tracking, and image compression capabilities. Once a target is locked, the gimbal camera continuously outputs the camera's field-of-view angular velocity relative to the target. The flight controller employs a proportional guidance algorithm to achieve automatic targeting and engagement of the tracked subject.

2. Product Features

- a) Features a power-on self-test function;
- b) Features visible light ISP imaging capability;
- c) Features target lock-on functionality;
- d) Features AI autonomous recognition of specific targets;
- e) Features autonomous target tracking after lock-on;
- f) Features the ability to reacquire and track targets after loss;
- g) Features aiming point fine-tuning capability;
- h) Features target pre-recognition functionality;
- i) Video compression capability;
- j) Output of tracking field-of-view angular velocity;
- k) Analog video output capability;
- l) Compressed digital video output capability;
- m) Firmware upgrade capability;
- n) Support for visible light and infrared cameras;
- o) Dual video input support capability.

3 Product Performance Specifications

3.1 Self-test Time

≤10 seconds.

3.2 Startup Time

≤15 seconds.

3.3 Single Continuous Operating Time

≥120 minutes.

3.4 Camera Input

3.4.1 Video Input Interfaces

a) Supports two MIPI interfaces for visible light detector input, enabling visible light imaging ISP functionality;

b) Supports two CVBS interfaces for analog cameras;

c) Supports one USB interface for camera input;

3) Resolution Input Support

3.4.2 Camera Configuration Options Provided

The PTZ cameras provided in this solution support both two-axis and three-axis configurations. The PTZ camera operates in either single visible light or single infrared mode.

Single visible light camera: Resolution 1920×1080, focal length 12mm, field of view 26°×15°;

Single infrared camera: Resolution 640×512, focal length 13mm, field of view 32°×24°.

The PTZ camera structure is illustrated below:



Picture 1 Two-axis gimbal camera



Picture 2 Triple-axis gimbal camera

3.5 Identification and Tracking Capability

Under meteorological conditions where horizontal visibility $VIS \geq 5000m$ and relative humidity $\leq 70\%$, with a target-to-environment temperature difference exceeding 5K and a typical target size of $6m \times 3m$:

1) When using a single visible-light camera with a detector resolution of 1920×1080 , pixel size of $2.9\mu m$, and lens focal length of 12mm, the parameters are as follows:

(1) Field of view range: $26^{\circ} \times 15^{\circ}$;

(2) Human-in-loop lock tracking distance: 1500m; autonomous recognition lock tracking distance: 750m;

(3) Tracking disturbance resistance: 64 pixels/frame;

(4) Tracking output frequency: 50Hz;

(5) Tracking accuracy: ≤ 2 pixels;

2) When using an infrared camera, the detector resolution is 640×512 pixels with a pixel size of $12\mu\text{m}$ and a lens focal length of 13mm. Parameters are as follows:

(1) Field of view range: $33^{\circ} \times 26^{\circ}$;

(2) Human-in-loop lock tracking distance: 850m; autonomous recognition lock tracking distance: 450m;

(3) Tracking anti-jamming capability: 64 pixels/frame;

(4) Tracking output frequency: 50Hz;

(5) Tracking accuracy: ≤ 2 pixels;

3.6 Output Video Signal Characteristics

a) Supports 1 channel of analog PAL video output, resolution 720P@25Hz;

b) Supports 1 channel of H.265 compressed video output, resolution 1920×1080 @25Hz.

3.7 Environmental Adaptability

Operating temperature: -20°C to $+60^{\circ}\text{C}$;

Storage temperature: -30°C to $+65^{\circ}\text{C}$.

4 Physical Characteristics

4.1 Power Interface

Power supply: 9V-15V; Steady-state power consumption $\leq 10\text{W}$; Transient power consumption $\leq 20\text{W}$.

4.2 Weight

Pan-tilt camera: $\leq 60\text{g}$;

Tracking module: $\leq 30\text{g}$;

4.3 Dimensions and Mechanical Interfaces

4.3.1 Mechanical interface of the tracker is shown in the figure:

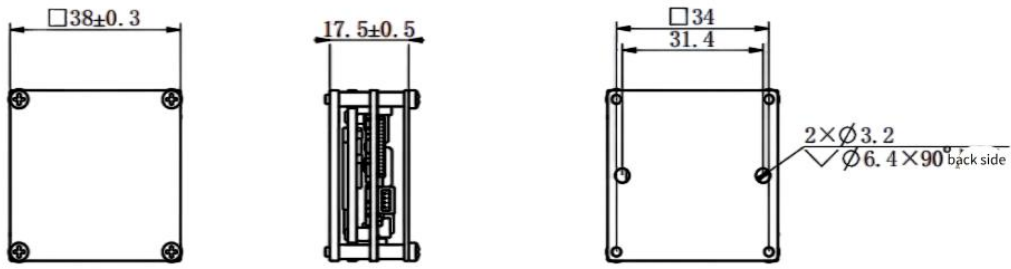


Figure 3 Mechanical Interface Diagram of the Tracker

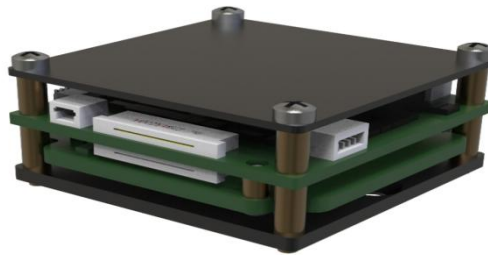


Figure 4 Tracking Component Appearance Diagram

4.3.2 Single Visible Light Camera Mechanical Interface:

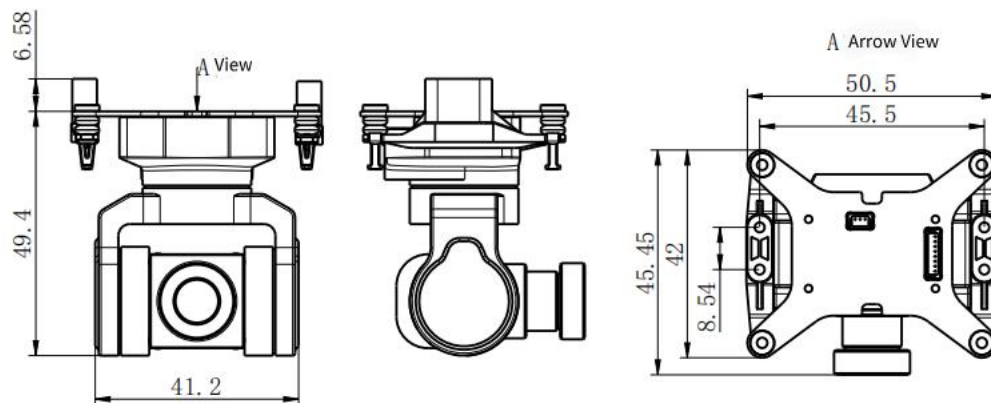


Figure 5: Single Visible Light Camera Module Dimensions

4.3.3 Dual Visible Light Camera Stitching Solution Mechanical Interface:

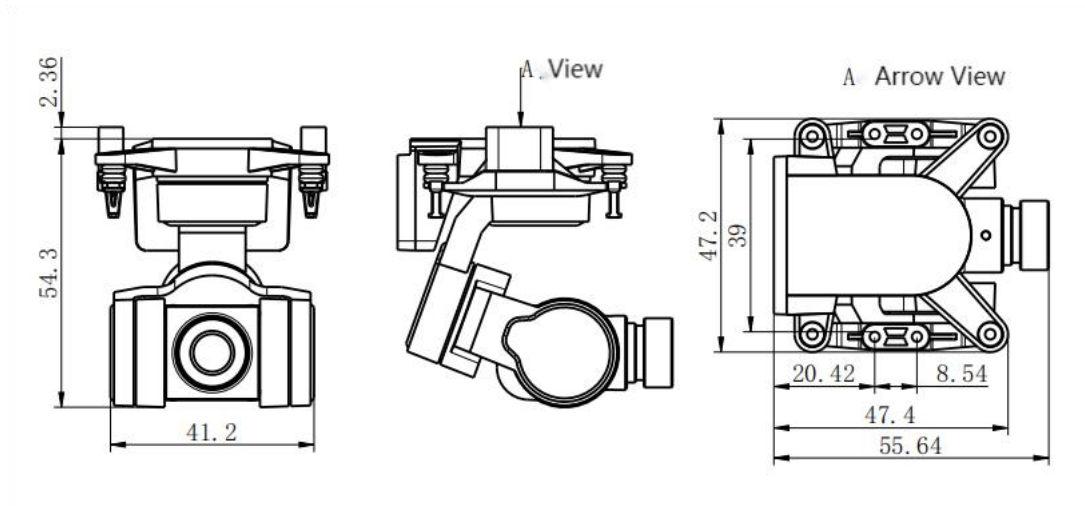


Figure 6: Dual Visible Light Camera Module Dimensions (Scheme 1)

4.4.1 Electrical Interface Specifications

- a) Equipped with 2 MIPI interfaces (one 4K input or two 1080P inputs) for connecting to digital cameras;
- b) Equipped with 2 PAL input interfaces for connecting to analog cameras;
- c) Equipped with 1 10/100M auto-negotiating Ethernet interface for connecting to digital video transmission systems and firmware upgrades;
- d) Features 1 PAL analog video output interface for connection to analog video transmission systems;
- e) Features 1 power supply interface compatible with 9V-15V power sources.

4.4.2 Electrical Interface Definitions

4.4.2.1 Tracking Module Interface Definitions

The tracking module's primary interfaces include: J1, J2, J3, J4, J5, J11, and power cables, as shown in Figure 7 below:

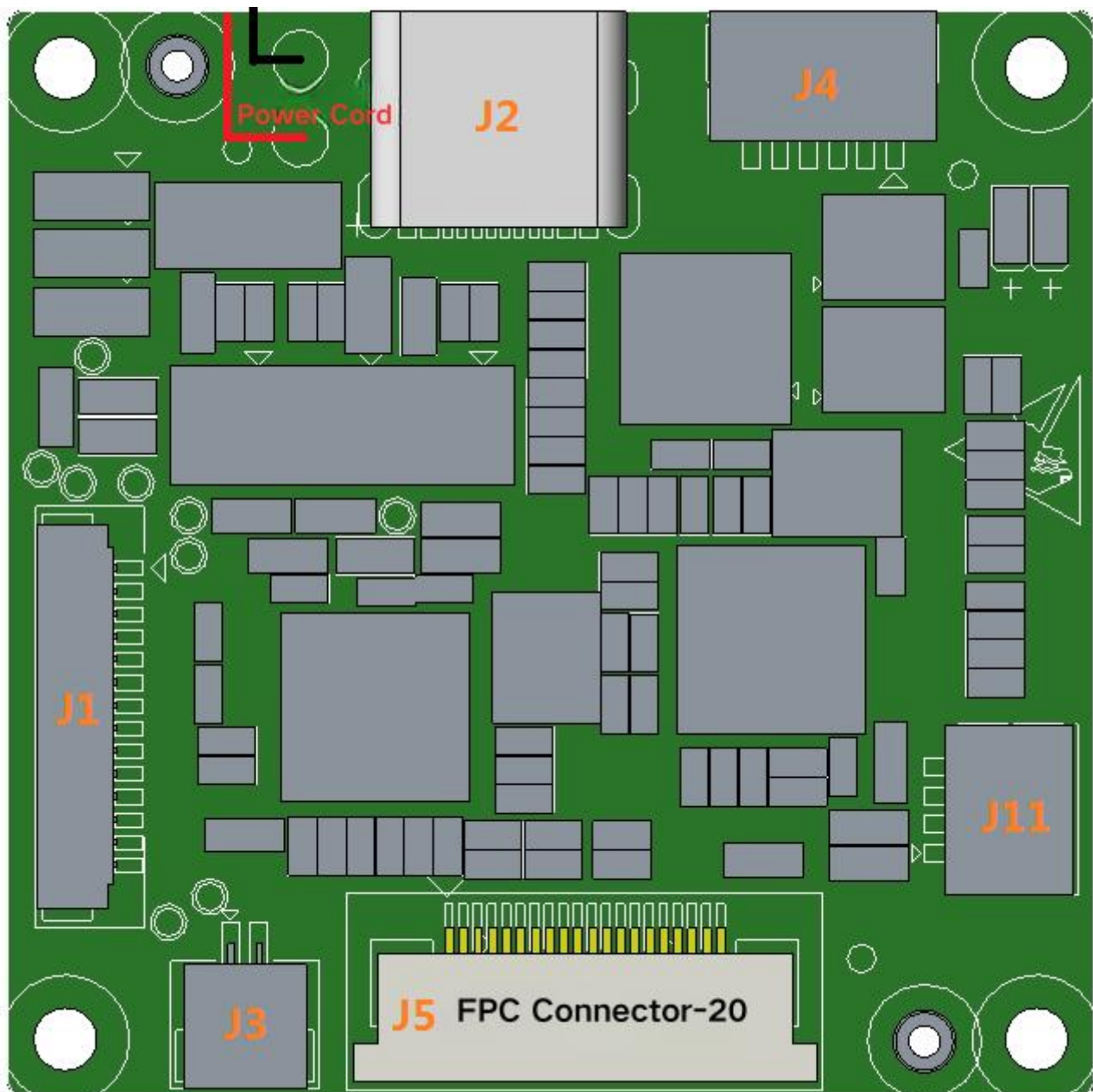


Figure 7 Tracking Module Connection Diagram

The power cable for the tracking module is wired with red and black wires.

Table 1 Power Cord Definitions

serial number	Signal Name	Signal Characteristics
Red line	VCC	9~15V
Black Line	GND	0

Tracking Module J1 employs a 14-pin connector with a single UART serial port for image control. The valid signals are defined as follows.

Table 2 Tracking Module J1 Terminal Definitions

serial number	Signal Name	Signal Characteristics
12	GND	0
13	UART4_RXD	3.3V
14	UART4_TXD	3.3V

Tracking module J2 uses a standard Type-C connector for debugging purposes;
Tracking module J3 employs a 2P connector for connection to the analog video transmission system, with the following signal definitions:

Table 3 Tracking Module J3 Terminal Definitions

serial number	Signal Name	Signal Characteristics
1	VTX	PAL Signal
2	GND	0

Tracking Module J4 employs a 6P connector for connection to the digital video transmission system, with the following signal definitions.

Table 4 Tracking Module J4 Terminal Definitions

serial number	Signal Name	Signal Characteristics
1	ETH_TX+	Ethernet signal
2	ETH_TX-	Ethernet signal
3	ETH_RX+	Ethernet signal
4	ETH_RX-	Ethernet signal
5	NC	/
6	NC	/

Tracking module J5 employs an FPC-20pin interface for connection to a digital camera, supporting one channel of 4-lane MIPI signals. The signal definitions are as follows:

Table 5 Tracking Module J5 Terminal Definitions

serial number	Signal Name	Signal Characteristics
1	MIPI_RX0_D3P	1.8V
2	MIPI_RX0_D3N	1.8V
3	MIPI_RX0_D2P	1.8V
4	MIPI_RX0_D2N	1.8V
5	MIPI_RX0_CK0P	1.8V
6	MIPI_RX0_CK0N	1.8V
7	MIPI_RX0_D1P	1.8V
8	MIPI_RX0_D1N	1.8V
9	MIPI_RX0_D0P	1.8V
10	MIPI_RX0_D0N	1.8V
11	SENSOR0_SCL	1.8V

12	SENSOR0_SDA	1.8V
13	SENSOR0_HS	1.8V
14	SENSOR0_VS	1.8V
15	SENSOR0_RSTN	1.8V
16	SENSOR0_CLK	1.8V
17	GND	0V
18	GND	0V
19	VCC_3.3V	Power Supply 3.3V
20	VCC_3.3V	Power Supply 3.3V

Tracking Module J11 features a 4P interface for connecting to analog cameras, supporting two analog camera signals with the following signal definitions:

Table 6: Terminal Definitions for Tracking Module J11

serial number	Signal Name	Signal Characteristics
1	5V	5V
2	GND	0
3	PAL_IN2	PAL Signal
4	PAL_IN1	PAL Signal

5 Typical System Application Connections

During the operation of the system through the mechanism guide, typical system application connections are shown in Figure 6

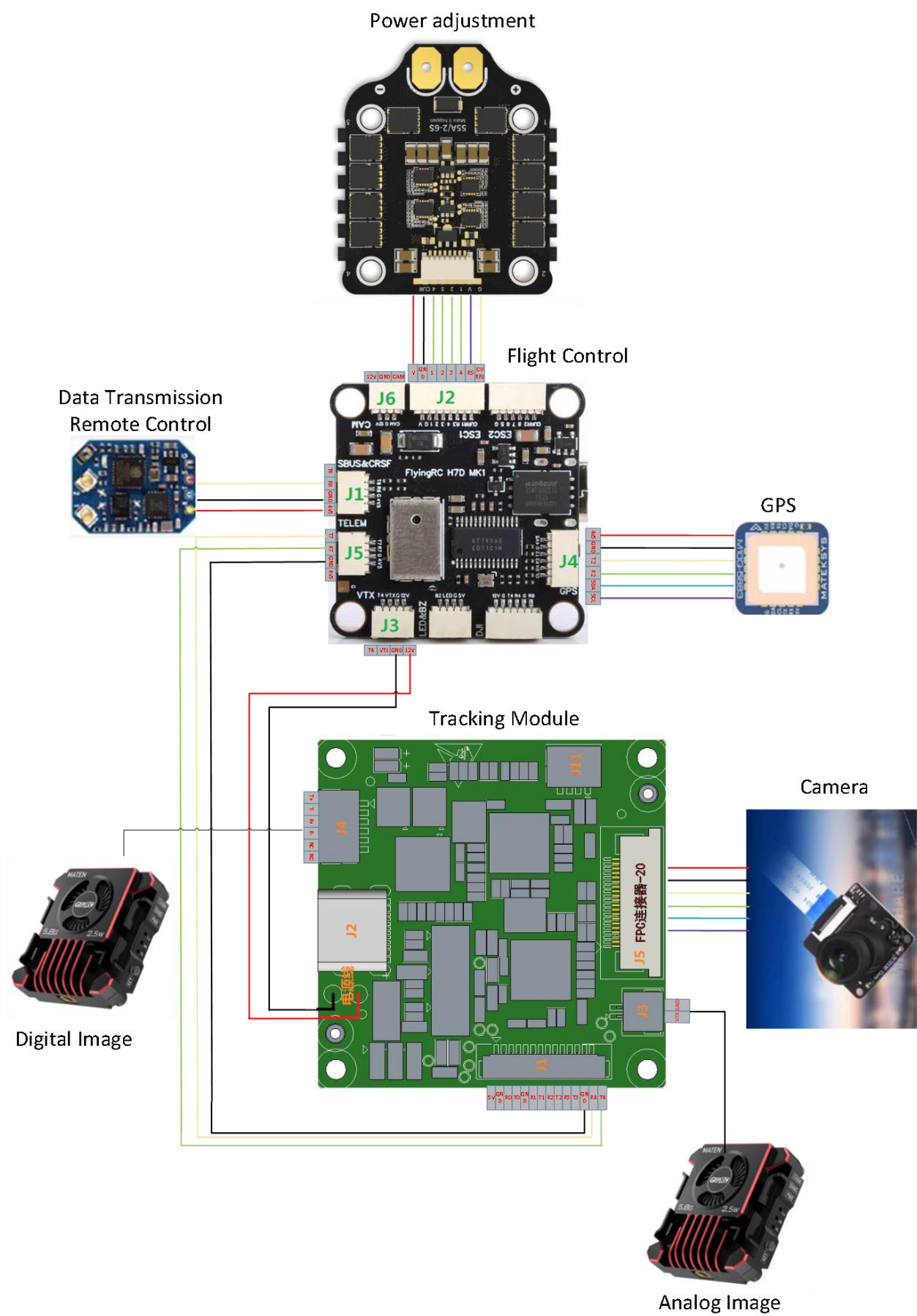


Figure 8 Tracking Component Connection Diagram