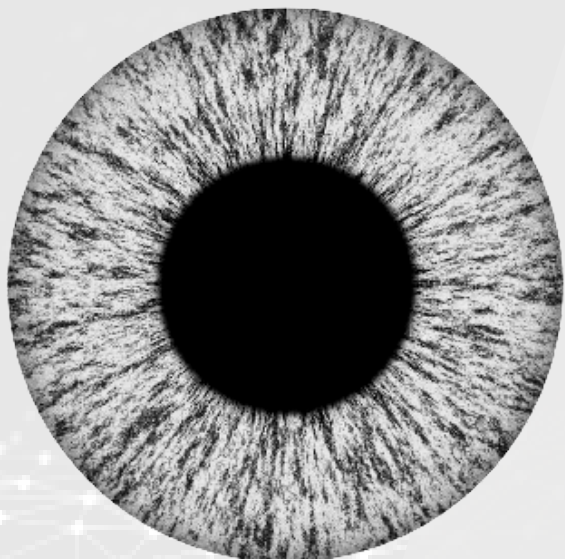


POLYHEDRUS

RUNWAY INSPECTION  
USING UAV





# Polyhedrus Vision System

The PVS is a state of the art embedded computer solution offering real-time image processing using Artificial Intelligence and advanced image processing algorithms.

The PVS utilises the latest in GPU technology, providing power efficient AI computing. The deep learning solutions are designed to be embedded and produce fast image processing, either in real-time or offline, to provide automation in the areas of damage identification, routine inspection, object classification and object recognition.

# Runway Inspection

Polyhedrus provides a bespoke runway inspection solution that operates during the runway closed period.

The UAV comes fully fitted with an Infra-Red illumination system providing an inspection that can be performed in pitch black conditions. Our optical system is designed to work in unison with the IR illuminators giving image resolutions of 0.5mm/pixel.

Depending on the area to be inspected, the UAV's can operate singly or can operate as a team, with each UAV having an area of the runway to inspect.

## Autonomous

The PVS is able to integrate seamlessly into most systems that provide or expose an SDK from their flight controller system.

Currently, support has been provided to allow the PVS to integrate into the DJI Matrice range of drones. When integrated into the DJI SDK, the PVS is able to take full, autonomous control, managing take-off, landing, velocity, height and return to base.



## Collision Avoidance

Polyhedrus has implemented its own form of Detect & Avoid technology providing full 360 degree monitoring up to a range of 100m. Support is also provided for downwards monitoring up to a range of 120m.

The collision avoidance system is integrated into the flight controller system and will take over the control of UAV when objects are detected within user controlled ranges.

The PVS also incorporates a Proportional Distance Algorithm (PDA), within the flight controller interface, allowing the UAV to decrease speed when objects are detected.

Using the collision avoidance system allows the UAV to fly at safe distances providing avoidance data at a rate of 50 times per second.

## Object Recognition

The PVS can currently be trained to examine defects including:

- Surface Irregularity
- Popouts
- Spalling
- Faulting
- Scaling
- Patching

## Analysis

Post UAV mission, the UAV will return to base where the inspection data can be downloaded and imported into the Polyhedrus PVS front end software.

The analysis software will allow the inspector to view all of the classifications, where anomalies were found, simplifying the previously laborious task of inspecting each individual image.

During the inspection the PVS will have stored every image that was taken of the object building a database of future, historic data, which can be used to further train the PVS artificial intelligence system.

The combination of the PVS software and the bespoke optical solution gives the inspection a new level of image resolution with 0.1mm/pixel possible.

## Workflow

Conventional UAV inspection workflow would generally have a dedicated pilot to fly to the inspection point, traverse the object, take images at pre-defined locations, return to base and then analyse the images.

Using the PVS provides a different method of workflow:

1. Initially the artificial intelligence system is trained with images representing known issues.
2. The mission is uploaded to the UAV.
3. The UAV will fly to the initial object – using advanced object recognition techniques, the PVS will autonomously start traversing the object, whilst controlling the flight controller to ensure movement is smooth and directional.
4. Images are taken at a pre-defined frame rate and analysed in real-time.
5. The result is then classified and stored in the PVS relational database system.
6. The UAV moves onto the next waypoint when the object inspection is complete.

## Technical Specifications

Power Supply: 12-30V DC / 35W<sup>1</sup>

Size: 185mm x 140mm x 90mm (LxWxH)<sup>2</sup>

Protection level: IP65

Storage: Options for mini PCIe SSDs up to 1TB

Interfaces:

- o Two internal cameras
- o USB 2.0
- o 10/100/1000 Ethernet
- o Rotary 360° Lidar or Fixed Lidar or camera based collision avoidance sensors
- o HDMI output for live video feed
- o UART interface to flight controller option
- o UART interface for gimbal control option
- o I2C/SPI/CAN interfaces available for bespoke systems

<sup>1</sup>Depends on camera configurations used. 35W is a typical figure for a two camera system.

<sup>2</sup>Depends on camera configurations used. This is a typical figure for a two camera system.

### Partners

NVIDIA Enterprise Partners  
DJI Enterprise Developers  
IDS Imaging Development Systems GmbH  
Basler AG



**E:** [info@polyhedrus.co.uk](mailto:info@polyhedrus.co.uk)

**T:** +44 (0) 7724 279808    **T:** +44 (0) 7710 430666

[WWW.POLYHEDRUS.CO.UK](http://WWW.POLYHEDRUS.CO.UK)