



# 3D\_rone



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# Contracted Pilot Conducting Inspection



Nominal Task Scenario



# Charley Thorton

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Charley is obsessed with new technology and toys. He is somewhat reserved, but will talk your ear off about his latest gadgets. He has a very nice PC, and feels right at home with a keyboard and mouse. He dropped out of college midway through an electrical engineering degree to start a business flying drones. It turned out to be a lucrative move. He is a certified drone pilot under FAA-107. His business often conducts wedding videos, building inspections, and land surveying. They once filmed a shot for a movie! Charley personally flies the drones whenever he can. Charley has a few friends, but they are very close.

# Contracted Pilot Conducting Inspection

Charley Thorton was hired to fly a drone to collect data on points within the building that need to be inspected. Because Charley has never flown in this building, he was given a device that has this application.

# Upload View - Using Defaults

Upload

Analyze

Upload Files

Building.glb

Upload

Inspection Points.txt

Upload

path1.txt, path2.txt, path3.txt

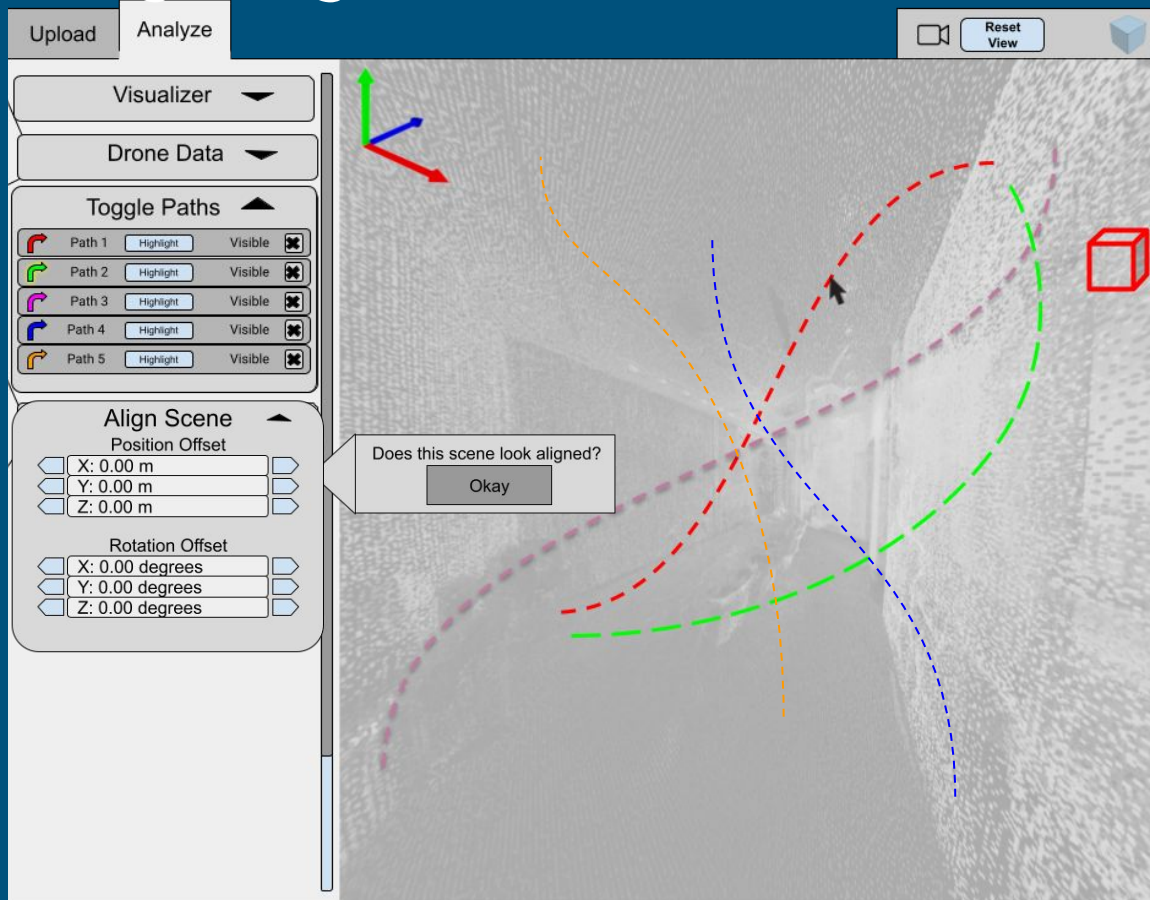
Upload

Development Version

Use Defaults

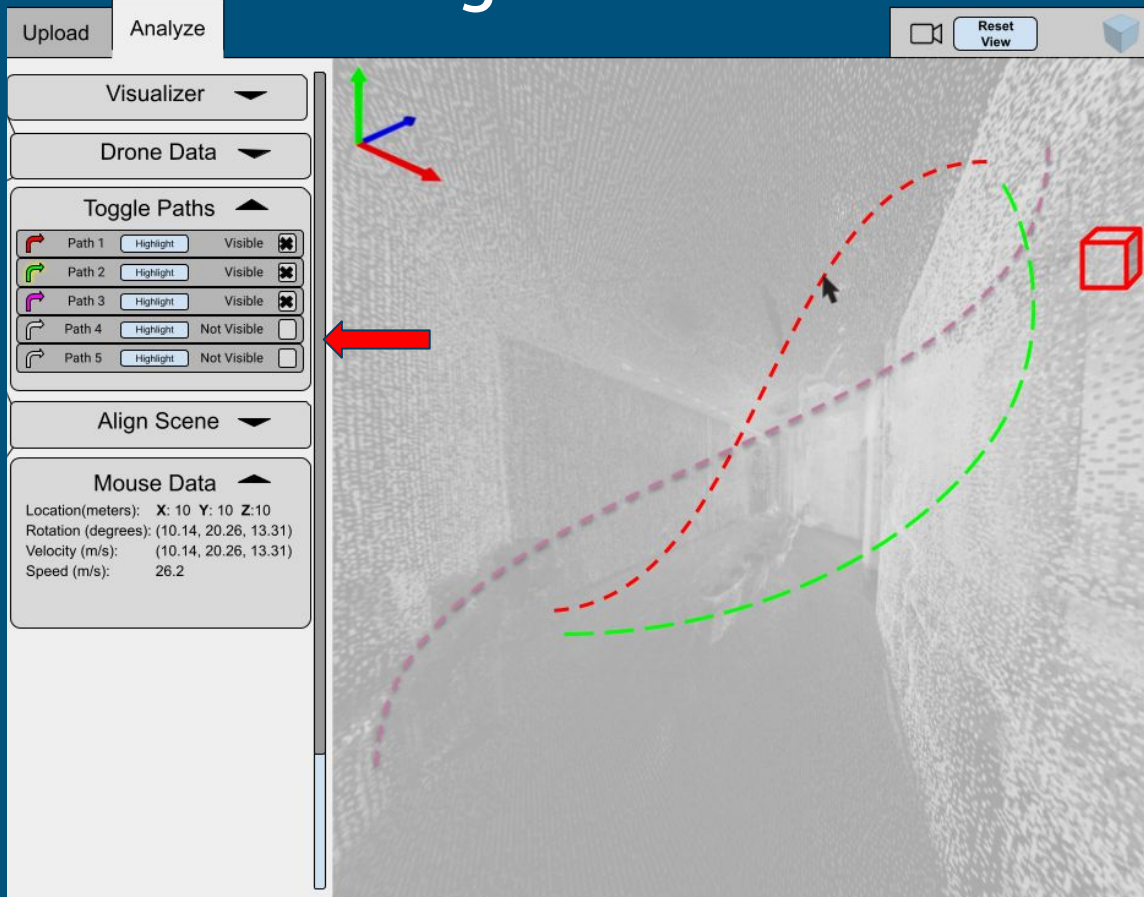
Charley is currently looking at the “Upload View” tab to upload files or to use the default files. Charley clicked the default button, as he was instructed. Charley then clicks the “Analyze View” tab that switches the view to the 3D representation of the building and the flight paths.

# Aligning Scene



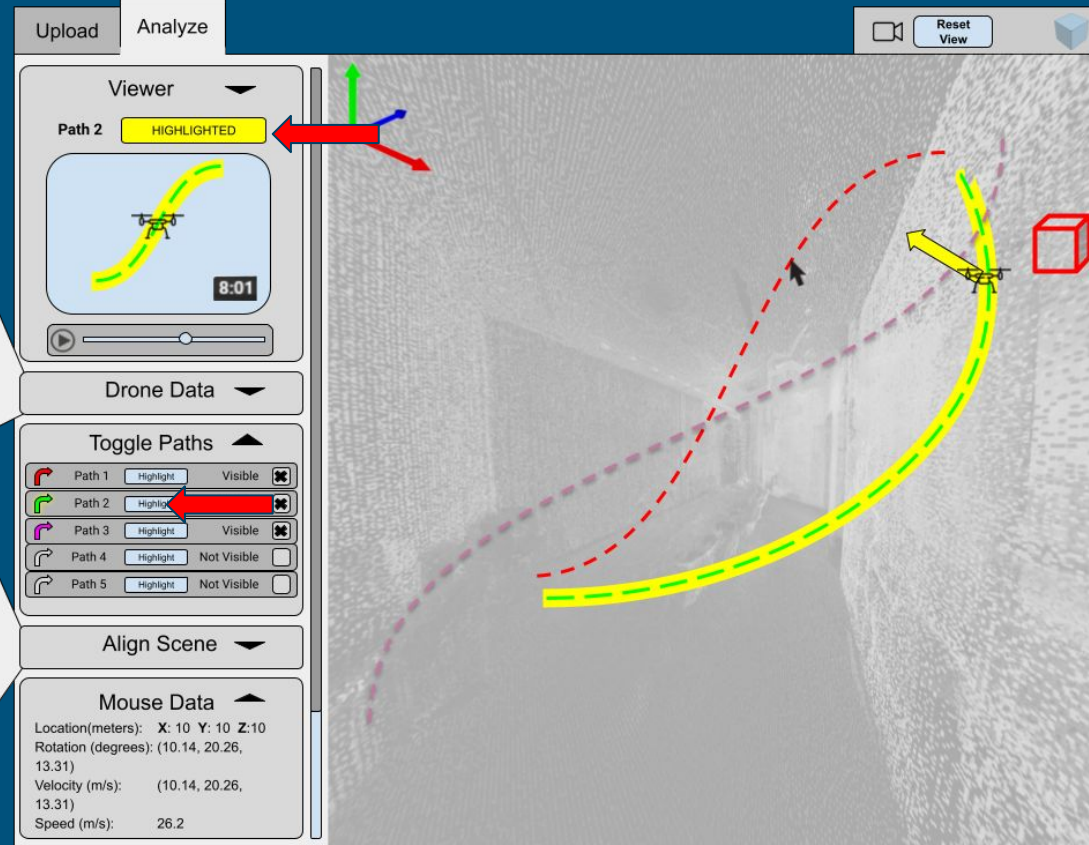
After switching, a modal appears, reading “Does the scene look aligned?”. Charley notices that the paths and inspection points do not match the current building location in 3D space. Charley notices there is an option to translate and rotate the building until the space matches up with the data points. When the 3D space looks accurate.

# Visualizing Paths



Charley continues on, using their mouse and keyboard to “fly” throughout the 3D space. Charley notices that the view is a bit cluttered because all of the flight paths are shown by default. Charley decides to toggle several of the paths to make the view less cluttered by clicking each path’s name in the path visualizer widget pane.

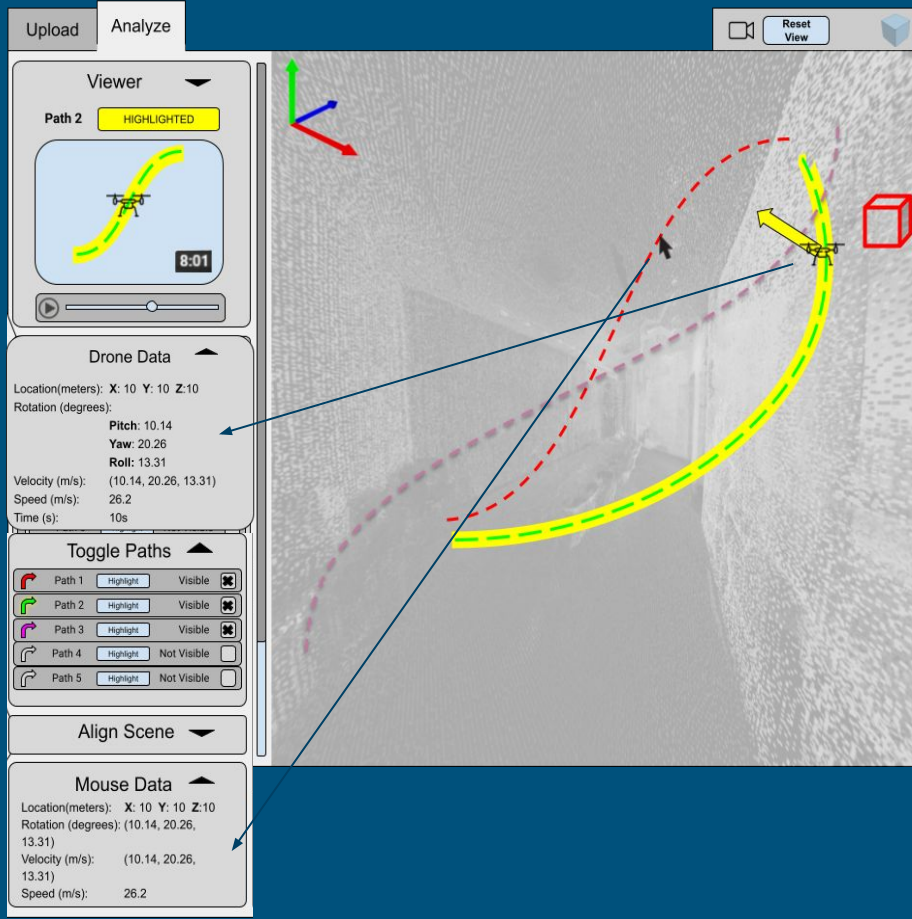
# Highlighting Paths



During this time they are curious about one of the flight paths that was taken. Charley wants to know what direction the drone was flying during this path and clicks on this path which highlights it, displaying a directional arrow.

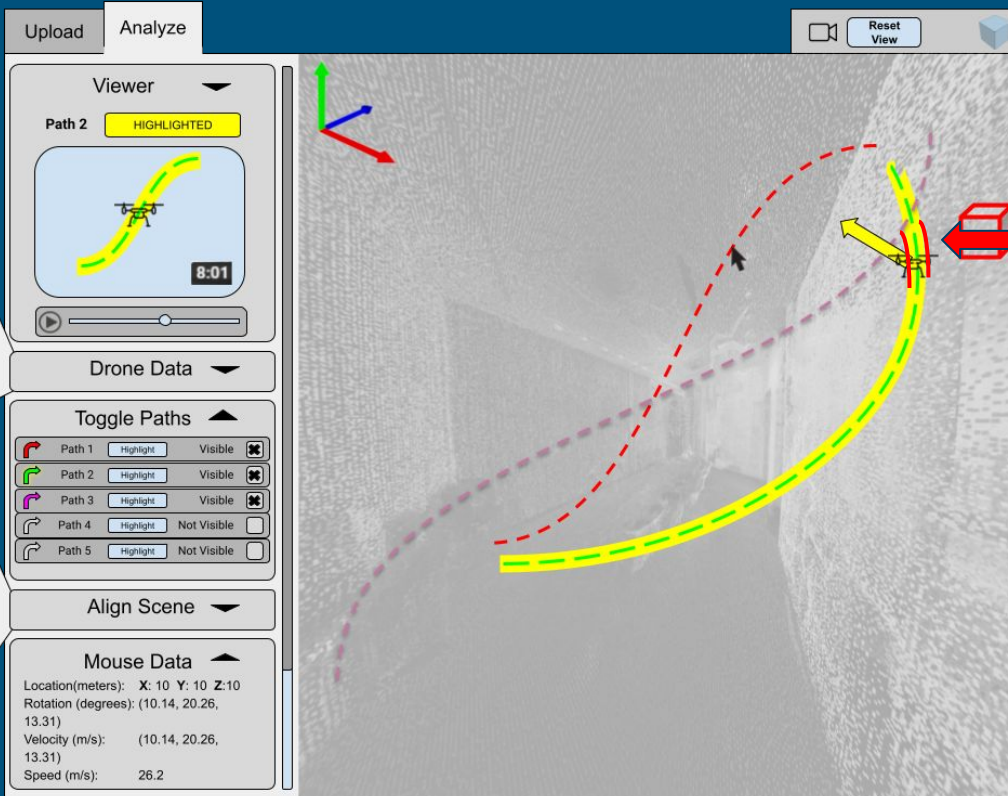


# Path Data



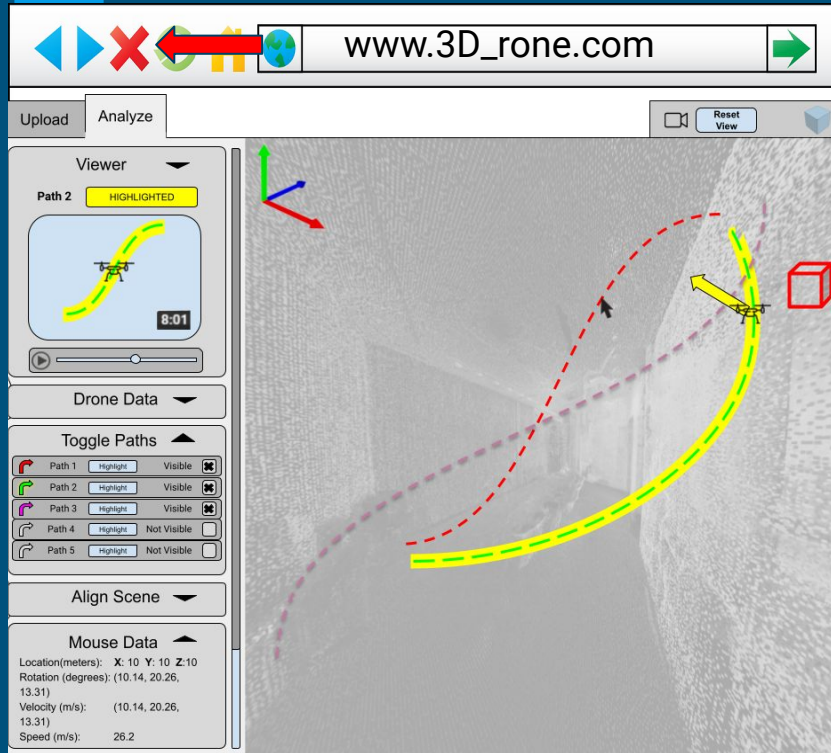
Charley wants to know how fast the drone was going and in what direction it was flying so they hover over the path at different points which populates the flight metadata viewer with the speed and pitch of the drone at that particular time.

# Points of Interest



At this time Charley is curious about any potential places where they might need to be more careful when flying the drone. They observe that certain places on the displayed path are red which indicates more time spent in that area. It is determined that those areas must be important.

# Finishing Up



Upon having navigated the 3D space and having viewed multiple potential flight paths, Charley feels confident in their ability to replicate such a drone inspection. Charley goes on to exit the web browser and close the application.



# Construction Worker Verifying Before Inspection



Error Scenario



# Will Foster

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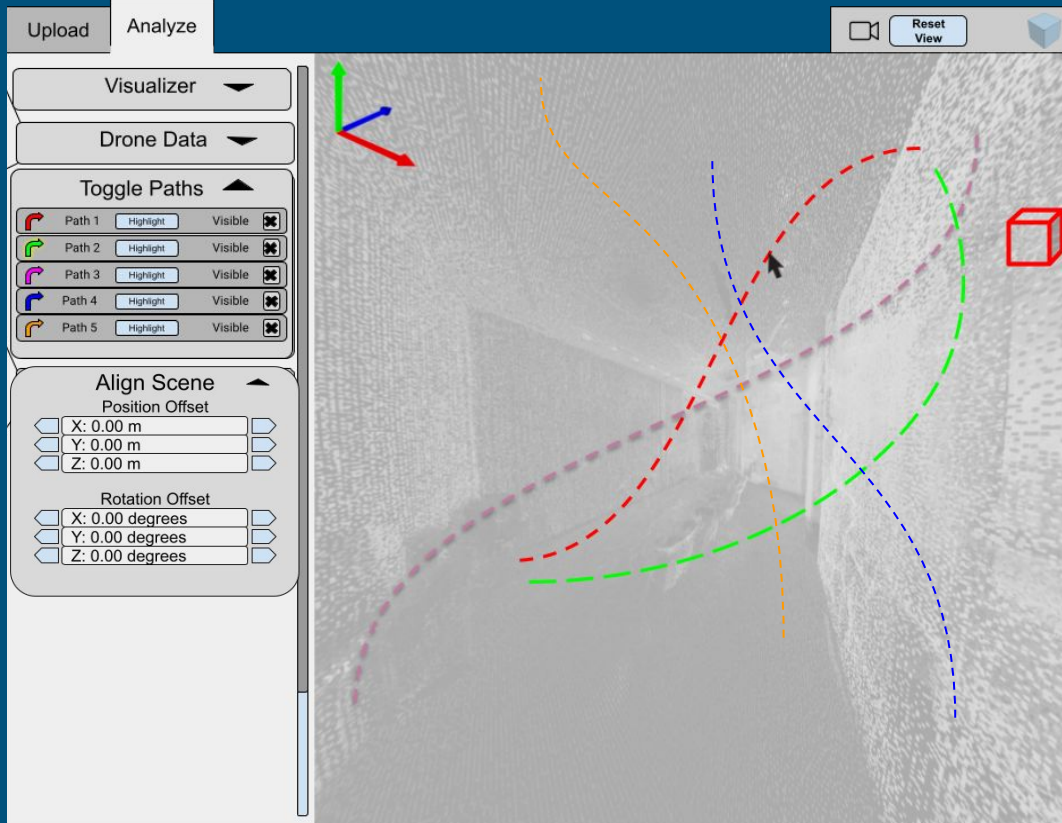
Will is a construction worker. He doesn't care one way or the other about his job, but he shows up every day. Many of his friends from high school have recently graduated from college with degrees. Will owns an older laptop, but doesn't care much about computers. He can usually figure out how to do what he needs with them. Will has flown drones before. He has worked as a construction worker since the age of 17, and has noticed them becoming more prevalent on work sites in recent years. He might buy one. He finds them fun, and that bad of a pilot.

# Use Scenario 2 (Error)

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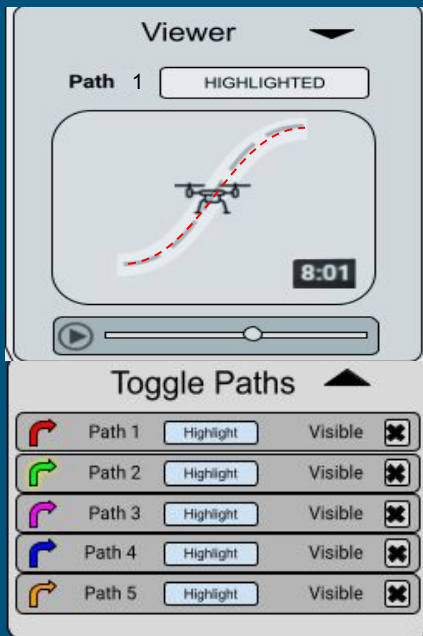
A building inspector will be inspecting an important site via drone in a few days and Will, a construction worker, has been asked by his manager to verify the inspection points are up to par via drone before the actual inspection. His manager uploads the model, inspection point, and path files to the site for Will's use.

# Analyze View



Will opens the application in the “Analyze View” tab. He now sees a 3D model of the construction site with marked inspection points. He also sees a list of possible paths on the side of the screen.

# Flight Paths

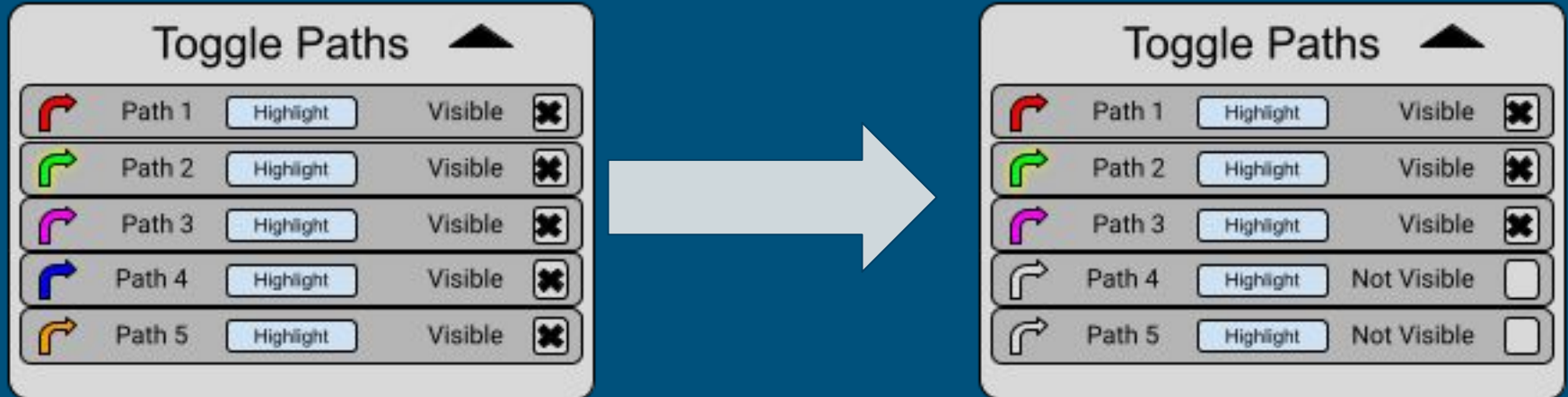


He notices that in the "Flight Paths" sidebar, only one path can be highlighted at the top. By default, Path 1 is highlighted and he can see its details as well as the path itself highlighted in the 3D space. He notices that there are four other paths listed. He wants to take a turn highlighting each of them.

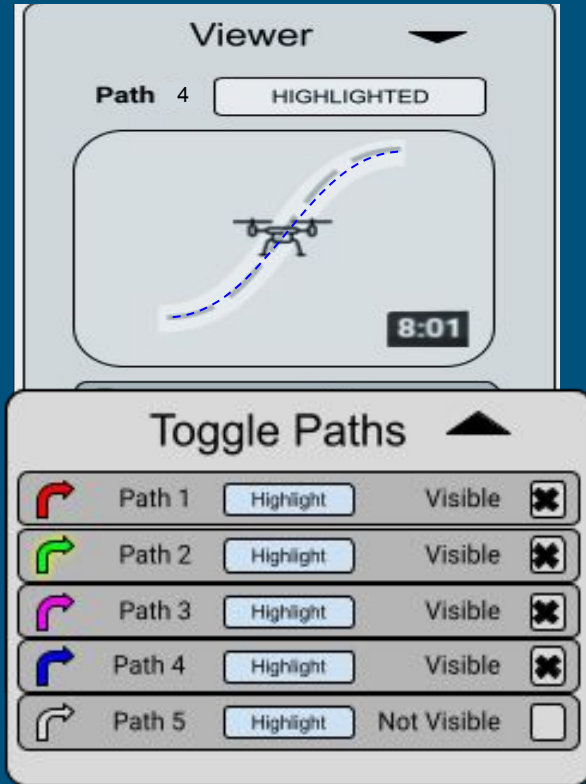


# Toggle Paths

He sees that each path has something labeled "Highlight" and also sees a checkbox checked next to every path. He assumes that the X in the checkbox next to each path means that the path is not highlighted, so he tries clicking the X next to Path 4 and Path 5.



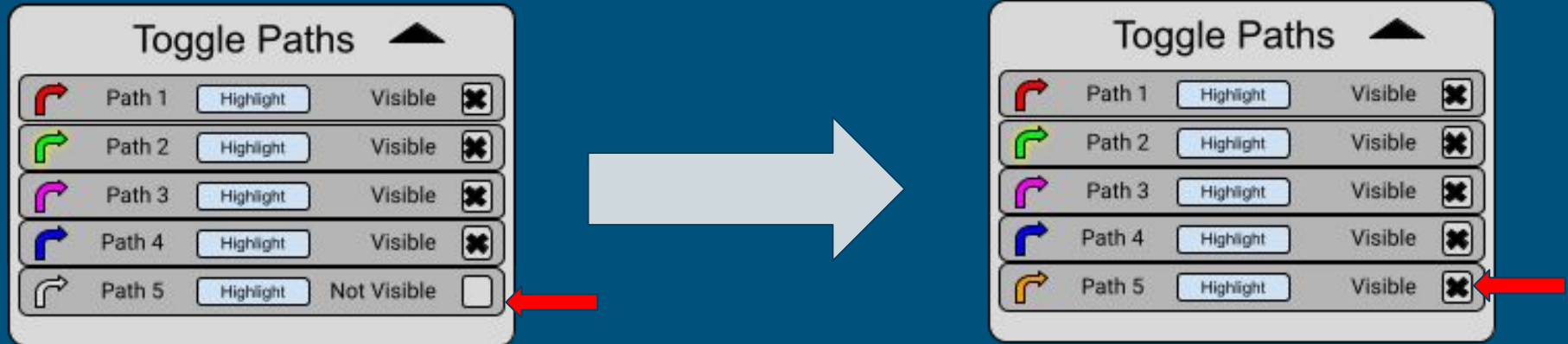
# Highlighting a Path



It doesn't look like that changes anything though, so he looks for something else to click. He realizes that the Highlight label is actually a button, and when he clicks the Highlight button for Path 4, Path 4 becomes the highlighted path. However, although Path 4 is now highlighted, he notices that Path 5 is now missing from the 3D space, and he cannot figure out how to make it reappear.

# Changing a Path's Visibility

He is finally able to fix his problem when he spies a label that reads "Visible" next to the checkbox he had clicked next to Path 3 before. He realizes that when he un-selected the checkbox before in an attempt to change the highlighted path, he accidentally turned off the path's visibility. When he selects the Visible checkbox next to Path 3 again, Path 3 appears once more in the 3D space.



# Component Overview

## Analyze View (Main View)

Where the path analysis tools are presented to the user

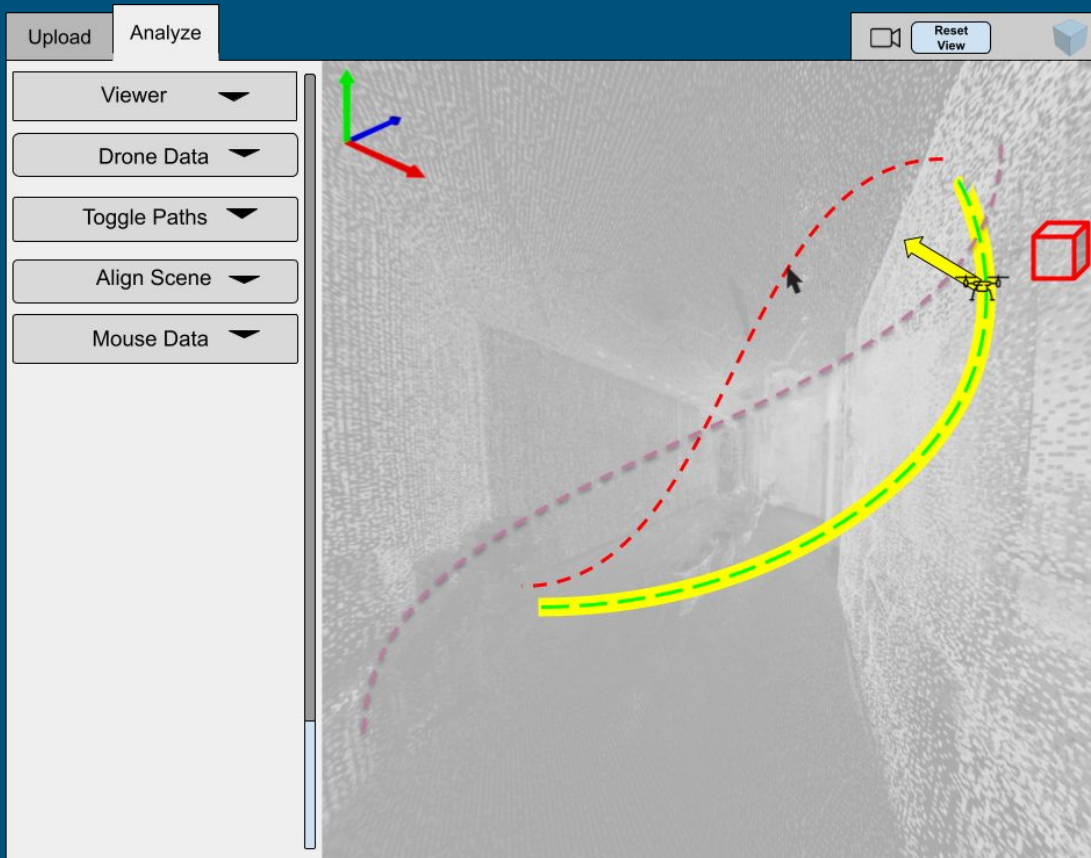
The interface is divided into several sections:

- Top Bar:** Contains 'Upload' and 'Analyze' tabs, a 'Reset View' button, and a 3D coordinate system icon.
- Viewer:** A dropdown menu showing 'Path 2' as 'HIGHLIGHTED'. Below it is a small 3D preview of the drone's path and a timeline slider.
- Drone Data:** A section displaying real-time drone information:
  - Location(meters): X: 10 Y: 10 Z: 10
  - Rotation (degrees): Pitch: 10.14, Yaw: 20.26, Roll: 13.31
  - Velocity (m/s): (10.14, 20.26, 13.31)
  - Speed (m/s): 26.2
  - Time (s): 10s
- Toggle Paths:** A section with five rows, each representing a path with 'Highlight' and 'Visible' checkboxes:
  - Path 1: Highlight (checked), Visible (checked)
  - Path 2: Highlight (checked), Visible (checked)
  - Path 3: Highlight (checked), Visible (checked)
  - Path 4: Highlight (checked), Not Visible (unchecked)
  - Path 5: Highlight (checked), Not Visible (unchecked)
- Align Scene:** A section with two sub-sections:
  - Position Offset:** X: 0.00 m, Y: 0.00 m, Z: 0.00 m
  - Rotation Offset:** X: 0.00 degrees, Y: 0.00 degrees, Z: 0.00 degrees
- Mouse Data:** A section displaying mouse-related information:
  - Location(meters): X: 10 Y: 10 Z: 10
  - Rotation (degrees): (10.14, 20.26, 13.31)
  - Velocity (m/s): (10.14, 20.26, 13.31)
  - Speed (m/s): 26.2
- Main View:** A large 3D visualization of a drone's path over a terrain. The path is shown as a yellow dashed line. A red dashed line indicates a different path. A red cube is visible on the right side of the terrain.

# Component Overview

## Collapsed Analyzer

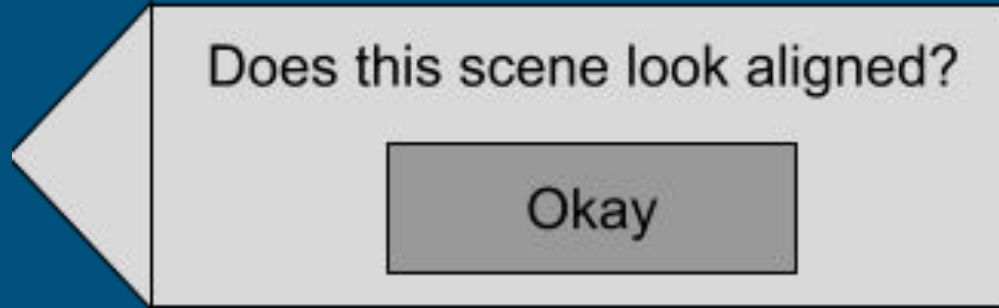
All analyzing tools in the sidebar are collapsible



# Component Overview

## — Scene alignment popup

Appears when the analyze view is first displayed. Points users to the scene alignment tool to realign the scene to the path and inspection points



# Component Overview

## — Align Scene

### Align Scene

Position Offset

◀	X: 0.00 m	▶
◀	Y: 0.00 m	▶
◀	Z: 0.00 m	▶

Rotation Offset

◀	X: 0.00 degrees	▶
◀	Y: 0.00 degrees	▶
◀	Z: 0.00 degrees	▶

# Component Overview

## Viewport

The main 3D view, showing the paths, scene and inspection points, as well as a directional arrow at the drone's position





# Component Overview

## Viewcube

Depicts the camera's current orientation via a cube. Pressing the "Reset View" button will move the camera back to the default orientation (Identity Quaternion) and position (Origin).



# Component Overview

## Viewer

Displays the drone's current position and time along the highlighted path. An animation of the flight may be stopped and started using the pause/play button, and scrubbed like a video using the slider.



# Component Overview

## Drone Data

Displays numerical data for the drone's current position. The drone is always located on the highlighted path at the current time depicted in the Visualizer

### Drone Data ▲

Location(meters): **X:** 10 **Y:** 10 **Z:**10

Rotation (degrees):

**Pitch:** 10.14

**Yaw:** 20.26

**Roll:** 13.31

Velocity (m/s): (10.14, 20.26, 13.31)

Speed (m/s): 26.2


Time (s): 10s

# Component Overview

## Mouse Data

Displays numerical data for the closest point on a path at the mouse's current position. This may be any visible path

### Mouse Data



Location(meters): X: 10 Y: 10 Z:10  
Rotation (degrees): (10.14, 20.26, 13.31)  
Velocity (m/s): (10.14, 20.26, 13.31)  
Speed (m/s): 26.2

# Component Overview

## Toggle Paths

The analysis tool that depicts all the uploaded paths. It allows path rendering to be enabled and disabled, and for paths to be highlighted



# Usability Goals and Concerns

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## Usability Goals

- Effectiveness/Utility
  - Provides user with all necessary functions and data to analyze a flight path
- Memorable
  - Sidebar organization and component logos make it easier to use the app over a couple uses
- Supports creativity
  - Users are given many options to explore and visualize the flight path, building space, and inspection point data

## Usability Concerns

- Learnable/Intuitivity
  - Lots of options and different ways of displaying data, takes some exploring, there might be a bit of a learning curve
- Efficiency
  - Limited knowledge about exactly how a novice pilot will use the app, prioritizing more effective features, how long should it take
  - Inability to view overall start, end, direction, and speed over a full path without scrubbing through viewer or hovering over path