Pier Structure from Motion Utilizing UAS

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Problem / Background:

Piers and Bridges are some of the most high traffic areas in the world. Piers and ports used for shipping and receiving world wide, and bridges used by the public to connect across bodies of water and connect across mountain sides. With that information, it is important that they are in perfect condition at all times.

Given the nature of their materials and construction, these structures are GPS denied environments. This causes concern for inspection. Inspections teams are sent out in hazardous environments and situations in order to inspect these structures resulting in lots of man hours spent and traffic interruptions for inspection.

Proposed Solution:

Utilizing UAVs that do not require GPS to navigate (Skydio X2D) alongside photogrammetry software (Pix4D), we can search for defects alongside a 3D model.

Revolutionary Work:

This project aims to complete a task that hasn't been able to be completed before, due to it taking place in a GPS denied environment. The Skydio X2D has 6 onboard cameras that are able to create a realtime environment of it surroundings to use for obstacle avoidance, as well as using for it's flight path. All without the need of a GPS connection.

Beneficiaries:

We aim to make 3 things happen as a result. Safer for current inspectors, removing the individual from having to go into dangerous areas and possibly risk their life. Faster processing time to recognise defects and issues. Cheaper on the companies that have to pay for the inspections.

Image via. Skydio

Image via. Dyck Memorial Bridge

How Computer Vision Helps:

It solves the issue of detecting small defects that the 3D mesh cannot pick up on. Using computer vision based algorithms, we can train our programs to specifically fit our needs. We can use the power of computer vision alongside the photogrammetry mesh to provide an accurate and thorough pier inspection.

Where this project can be seen in 10 years:

In 10 years, we aim that this project will have been under use for some time. This will allow for historical records of analyzed structures that can possibly lead to visual and physical patterns of decay over time. This can help us attempt to future proof future construction by adding aid to the areas where decay and damage is common.

Results / Accomplishments / Next Steps:

We demonstrated that we are able to create 3D models using structure from motion without the use of GPS. Whereas the quality of the models needs work. This can be achieved by capturing better quality images or working with other softwares that excel in 3D mesh quality (ie. Bentley CC).

What We Learned:

Increased Quality = Increased Time

Flying requires a pilot's license

Flights have to be cleared well in advance

Detailed meshes that show defects are mandatory for inspection