A Modern Look on Heritage

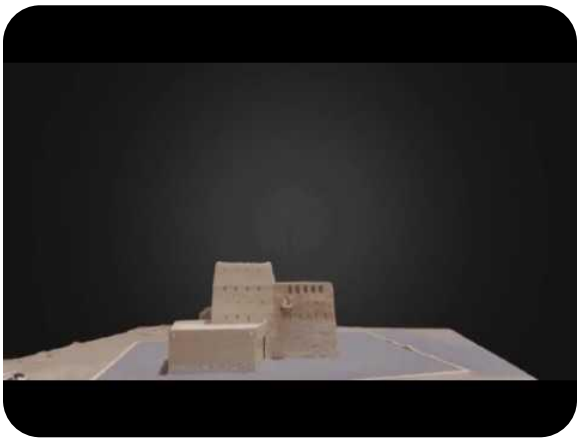

Figure 1. 3D portrayal of an ancient Guard Tower in the Sultanate of Oman

Heritage, a term that is regarded to be invaluable in the Omani community; is essentially an inheritance. This inheritance can be in the form of land, art and even honor. In the case of this relatively small guard tower in the middle of nowhere it is in the form of brilliance. Brilliance in the architecture, purpose and careful construction such that this tower stands even after it's builders are long gone. The analysis of this landmark provides better understanding of the conditions and way of life of the previous generations. By employing an unmanned aerial vehicle (UAV) it is possible to provide further analysis of such heritage and a 21st century perspective on it. A UAV can deliver a detailed 3D model of the building as shown in Figure 1 and other analytic tools like: 2D maps, elevations, volume, area…etc.

3D Model

To obtain a thorough 3D model of the tower the SigmaX team took over 100 still images of the tower. To generate the model different algorithms are then applied to stitch together these images. First the UAV took pictures from an altitude of approximately 20 meters to get an accurate 2D map. Then the UAV was set to take pictures in an orbital route around the tower to compliment and construct the 3D model.

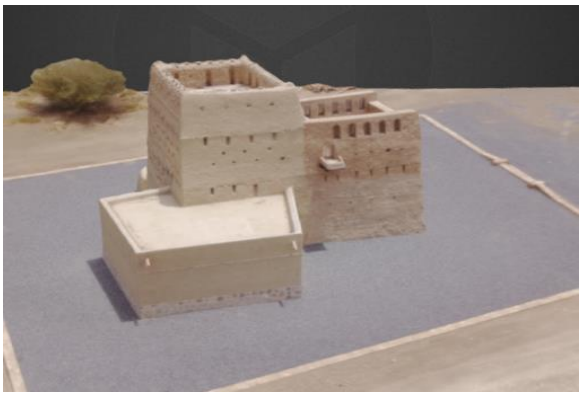

Figure 2. 3D model from the east side of the tower

Figure 3. Actual still image of the tower from the east side

Figure 2 and 3 show a comparison between the 3D model and an actual picture of the tower. Both figures reveal the east side of the tower. Evidently the two images are almost identical. The model shows even the smallest of holes and imperfections in the structure. This kind of detail is almost impossible to produce in a 3D design software like those used for buildings and infrastructure. Similarly, the 3D model is superior in the sense that it gives the freedom to look at the tower from any angle and height.

Further Analysis: Elevation

In this application elevation is not a necessarily a beneficial tool, but it is certainly an interesting one and a testimony to the accuracy of the data provided by the UAV.

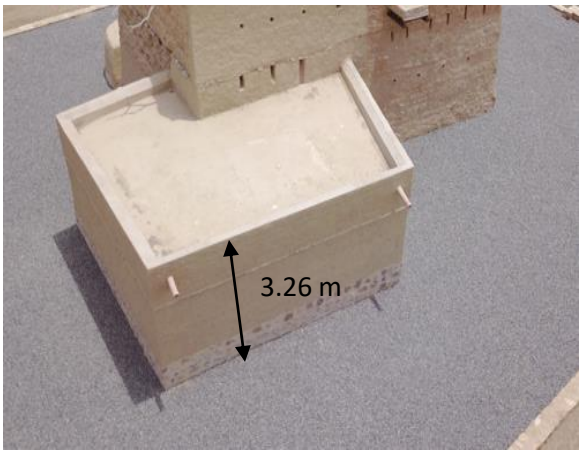

Figure 4. Wall at east side measured to be 3.26 meters tall

To get a rough estimate of how accurate the elevation is, the SigmaX team measured the wall on the east end.

The difference between the points shown in figure 5 is the height of the wall. This difference is calculated to be 3.28m which is only 2 centimeters greater than the height measured. This is a relatively accurate method. It is also less time consuming than the traditional methods used. The accuracy can be improved by using ground control points (GCPs).

Another intriguing result was the fact that the height of this wall was not constant. In fact, the height increased from left to right. This kind of finding is normally difficult to detect by the naked eye, yet it is very simple and easy with the aid of a UAV.

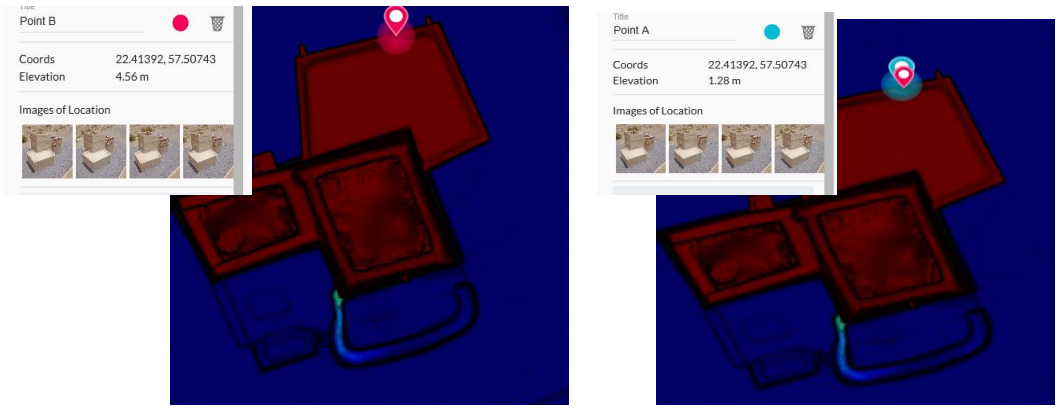

Figure 5. The data shows that at point B (on the wall) the elevation is 4.59m while point A (on the bottom) the elevation is 1.28m.

Conclusion

A UAV certainly shines a modern light on this ancient tower. It paints it in a different view and provides the ability to further analyze and understand such landmarks. It is a modern look on heritage.

