Digital model of an existing building a wild riverbed in Tokyo

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ABSTRACT

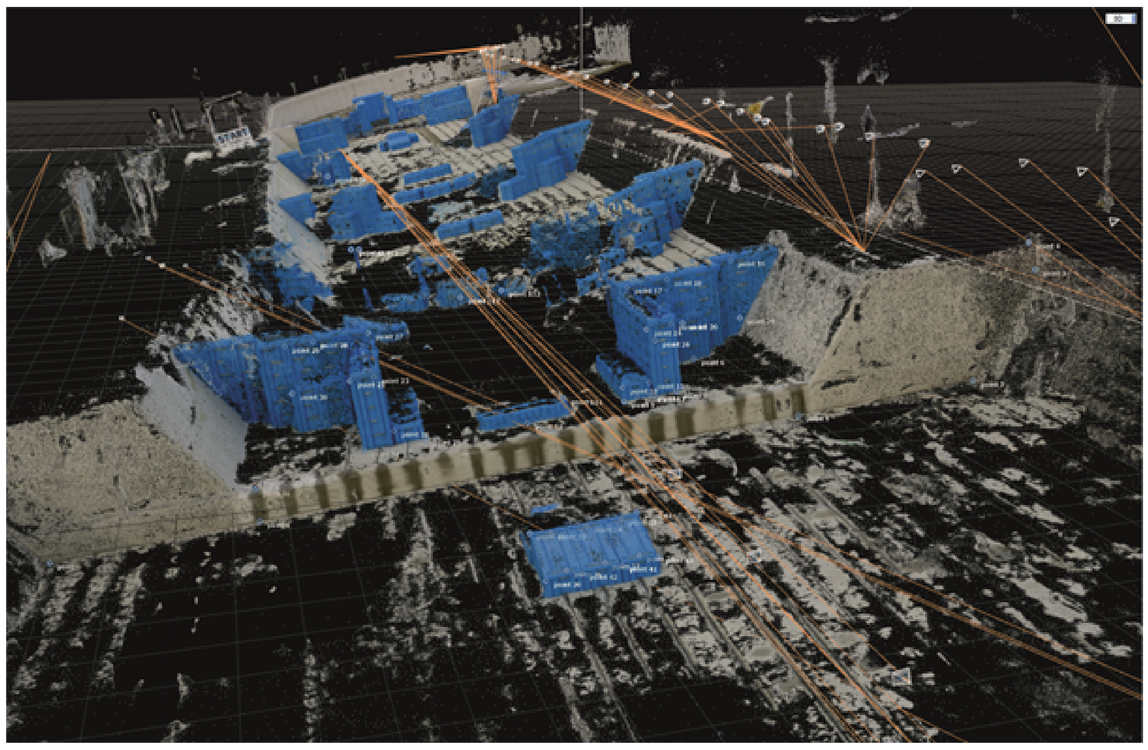
This paper presents an application of photogrammetric methods for so-called image based modelling and rendering. Digital photogrammetry technology was used for the real use of a digital model of an artificial riverbed for a wild river in Tokyo. This technology was applied using two software programs, where we evaluate their compatibility and propose measures that should increase efficiency in the future in the creation of digital models of existing buildings. We describe the process of creating a model in both software separately and evaluate their use for a given type of object. In this paper, we describe the individual processes from the selection of photographs through the cleaning and smoothing of the point cloud to the final model. We present the practical use of the created digital model. In the pictures we show the solved structure, the process of joining individual photographs and the final model for the overall idea of the application of this method. The results and discussions section describes the evaluation of both software and proposals for measures for their use, especially for water structures of a linear nature containing recurring elements such as water barriers.

General view of the construction of an artificial riverbed for a wild river in Tokyo

RESULTS

The final model consists of only 800 of the 1800 photos taken. From the experience of other projects focused on the creation of digital twins using digital photogrammetry, we know that appropriate preparation before the actual shooting is the most important aspect of the whole process. It is necessary to precisely plan the process of taking photographs, especially for larger or linear constructions. Furthermore, the setting of the camera angle, focal length and, last but not least, lighting conditions. Outdoor photography is unpredictable, but that is why it is necessary to carefully plan the photography so that the shortest possible time runs so that the lighting conditions do not change much during the photo shoot. In this particular case, it would be possible to use aerial photogrammetry using a drone, which we unfortunately didn´t have at the time of the photo shoot.

There are more software that supports digital photogrammetry, but each works a little differently, so you need to take photos according to the capabilities of the software used. The last thing that would be good to use are puncture points, which would make it easier to connect the model. Especially for objects that have a large number of the same or very similar parts such as flat surfaces or repeating masses (in our example, water barriers).



The process of creating a point cloud in Reality Capture software

CONCLUSION

From the presented results it can be said that both software can be used for the creation of digital models. The accuracy of the model is the same but if the model contains glossy surfaces the Reality Capture software is significantly better. In addition, this software is more suitable for large objects that need more than 200 photos, which is the maximum possible number per upload in Autodesk Recap Photo software. For example, a lower number of photographs is sufficient for a digital model of a sculpture, but for larger objects such as buildings, the number of photographs is usually in the hundreds. Both software are suitable for editing the point cloud and then exporting the data.

The price for digital photogrammetry, as opposed to 3D scanning, is mainly supported by the price, when the price of the equipment needed to take photographs is significantly lower than the purchase price of a 3D scanner. Furthermore, the evaluation of data is largely automatic - certainly in the example we selected, it was necessary to connect part of the model manually, but only because it was a very demanding object.

Digital photogrammetry can be used as well as 3D scanners in construction. In particular, linear and tall buildings will be possible to better and more accurately model using aerial photogrammetry, especially today, when drones are becoming more available. The future is a combination of both of these methods. The digital model created in this way can serve as a basis for a building information model (BIM).

Finished digital model in Reality Capture software

Acknowledgment

This work was supported by the Grant Agency of the Czech Technical University in Prague, grant No. SGS20/103/OHK1/2T/11

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