May 7, 2019

Lots and lots of dots

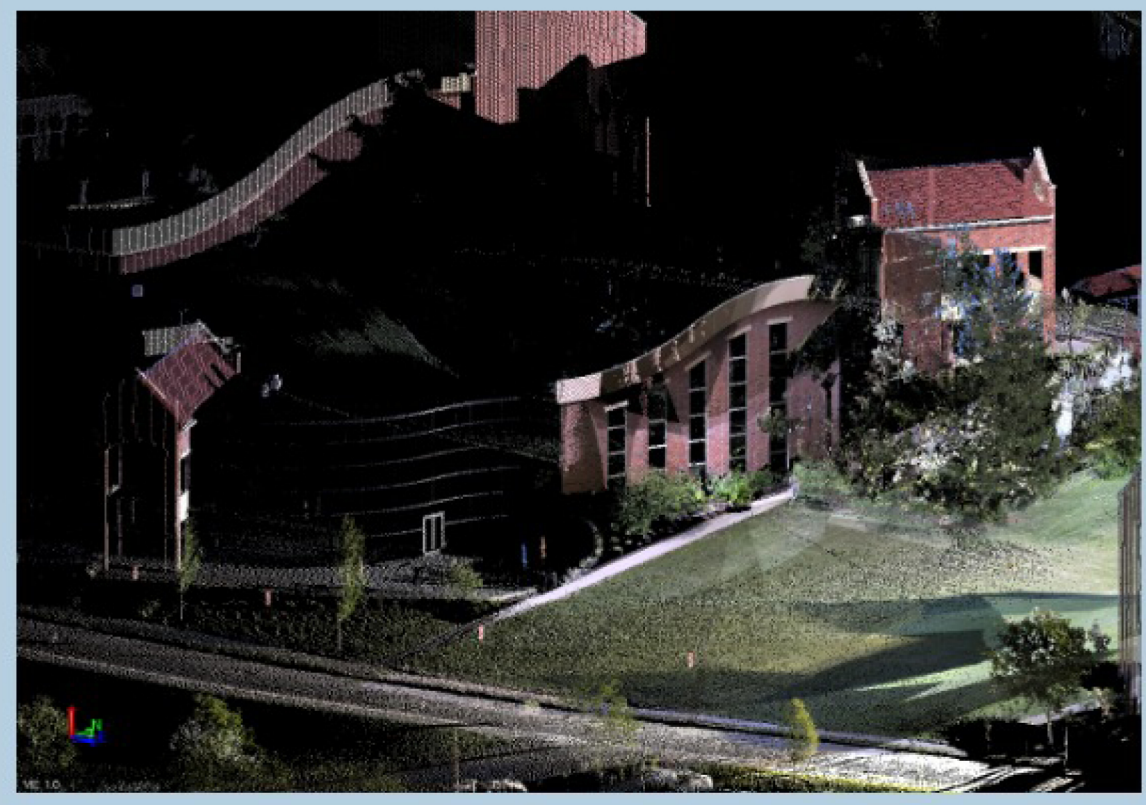
Since 1852, the University of Dubuque has been nurturing the minds, bodies and spirits of young men and women on its campus in Dubuque, IA. Understandably, that campus has grown and changed dramatically, but incrementally over the decades. As is typical at most large institutions, accurate records of many of those changes had not been kept.

In anticipation of a significant planning project, the University needed a comprehensive survey that would detail exactly what's been built and where. In addition to building sizes, shapes and locations, campus planners needed to know the location and dimensions of every fence, walkway, driveway, lamp pole, manhole, tree, shrub and park bench.

Conducting such a survey using conventional methods could take months and be prohibitively expensive. So WHKS surveyors proposed using a relatively new technology - 3D laser scanning.

A laser scanner sends out hundreds of thousands of laser pulses per second which bounce off the buildings, lamp poles and benches and return to the sending unit. By measuring the time required for the pulse to go out and return the unit can calculate the exact location in space of the dot where the laser hit. Because the scanner sends out so many pulses, the resulting data, called a point cloud, can then be translated into a 3-dimensional model of the surroundings.

Of course, an entire university campus can't be scanned from a single location. Buildings block one another creating point 'shadows' in the model. By moving the scanning unit to a number of different locations, the shadows can be eliminated. Surveyors set up a series of 'control points' that can be sensed from several of the scanner locations, which allows them to accurately combine the digital models and create one comprehensive model that includes the entire campus.



This image is the point cloud from the scanner. The image shows how the number and colors of the points can reveal almost as much as a photograph, but each point has an x, y, and z dimension.

In addition to the huge benefit of such an accurate and comprehensive model of the campus, the survey was completed in weeks instead of months and the cost was lower than a much-less-inclusive conventional survey.