Examining the accuracy of a 3D scanner

Caitlyn Ryan
Mercer University

Background

Optical, or 3D, scanning is used highly in bioprinting, the construction of biological structures using 3D printing techniques. Currently, bioprinting is used for the manufacture of non-living prosthetics such as dental crowns, artificial limb and hearing aids. Ten million people currently use 3D printed hearing aids. 3D scanning is integral to the manufacture of custom implants and other medical devices. There are several devices that are used for optical scanning, but many are very expensive. Recently the Xbox Kinect sensor has been used for 3D scanning, mainly people and objects. However, this technology could be used for many other things, including bioprinting.

Purpose

The purpose of this project was to determine the accuracy of the Kinect 3D scanner and determine whether or not it was viable for commercial use.

Design/Method

The Xbox Kinect sensor was analyzed quantitatively and qualitatively as a 3D scanner. In order to measure the accuracy of the sensor, a small, symmetrical box (70 mm x 40 mm x 21 mm) was scanned with both the Xbox Kinect sensor and the NextEngine 3D Scanner. To measure the Kinect sensor's ability to reproduce more complicated objects, an office chair (scaled down to 5% of its original size) was scanned. The scans were then edited into viable design files and printed using the MakerBot Replicator 3D printer. Quantitative analysis consisted of determining the percent difference between the 3D print and the original for each measurement, as well as total volume. Qualitative analysis was based on visual comparison between the original and 3D printed objects.

Results

Scanning a small symmetrical box with the Xbox Kinect sensor resulted in a very inaccurate 3D printed version. The percent difference between the original and print ranged from 37.8% to 51.1% for the three dimensions. Additionally, the topography of the 3D printed Kinect scan was very variable. The laser scanned small box had a maximum percent difference of 6.4% and had a very smooth topography. The office chair, on the other hand, had a percent difference of only 1.8%.

Conclusions

The large error in dimensions and physical appearance of the Kinect scanned small box was due to the 0.5 m – 5 m operating range of the sensor. Additionally, it is difficult to 3D scan symmetrical objects such as boxes, because the scanner cannot distinguish between the sides. This confuses the scanner, which then renders an incomplete or badly misshapen object. The office chair was not the same on all sides and it was large enough for the scanner to sense it. When the basic requirements of scanning (i.e. size and shape) are met, the Kinect scanner results in an accurate replica. However, this may not be a viable option for bioprinting since the range for bioprinting is much smaller than the operational range of the scanner.