METHOD
Participants were selected from a database of 800 3D hand scans that was collected during 2019 Minnesota State Fair. Fifteen 3D, full-color right-handed scans were selected based on manual hand breadth percentiles (min/5%/25%/50%/75%/95%/max). All scans are scanned using Artec Leo. Prior to scanning, the hand of the participants was landmarked with a washable marker.

Seven measurements taken in Manual and automatic measurements using the same digital landmarks. For manual measurements, each measurement was taken 3 times in Anthroscan and recorded. Anthroscan 2018 (version 3.6.1) by Human Solutions GmbH was used for digital landmark placement and extracting the dimension. Programs for automatic measurements were developed in Visual Studio (Microsoft) using VB script.

Automatic Measurement (A)
For automatic measurements, the physical landmarks were relocated digitally. Then, the system extracted the dimensions automatically using a program written in Microsoft Visual Studio.

Conventional Measurement (C)
For conventional measurements (C), physical landmarks and dimension measurement were done manually on Anthroscan by a skilled measurer. Each measurement was measured three times to avoid measurer’s error.
So, the circumference measurement divided into halves to connect all landmarks. ‘takeOpenTapeMeasure’ function used for the measurement.

**RESULT**

Basic statistics and mean difference for Conventional (C), Automatic (A), and Semi-Automatic (SA) measurements were calculated. The type-I error rate was assumed to be $\alpha = 0.05$. For conventional and automatic measure, no difference was found for linear measures. But for circumference measures, a statistically significant mean difference found between conventional and automatic technique. The reason found to be the taken unintentional path in automatic measuring system.

**CONCLUSION**

For linear measurements of 3D hand scans, automatic measuring technique is an accurate and reliable method when for circumference measurements and surface measurements, a semi-automatic measurement method showed improved result. Automating measuring process will make 3D scanning affordable for industrial use.