

# Methods and Tools for 3D Capture of Hands and Feet

## INTRODUCTION

While the human form has been analyzed in global anthropometric surveys using 3D scanning technology, hands and feet data have not been collected and examined. There is a need to examine the 3D hand and foot form across diverse populations in order to improve products for the everyday user and occupational users that rely on these products to keep them safe on a daily basis.

The Structure Sensor Scanner is a new, inexpensive scanner that attaches to an iPad. The Structure Sensor Scanner was validated in the Human Dimensioning Lab as a tool to capture the 3D body and extract reliable measurements. This scanner is ideal to take to various sites to scan diverse populations of users and can accurately capture the hand and foot form with high resolution. While the Structure Scanner technology enables the capture of the 3D form, protocols need to be developed for new technologies to ensure accuracy, develop best practices, and minimize user error.



Structure Scan with iPad



## PURPOSE

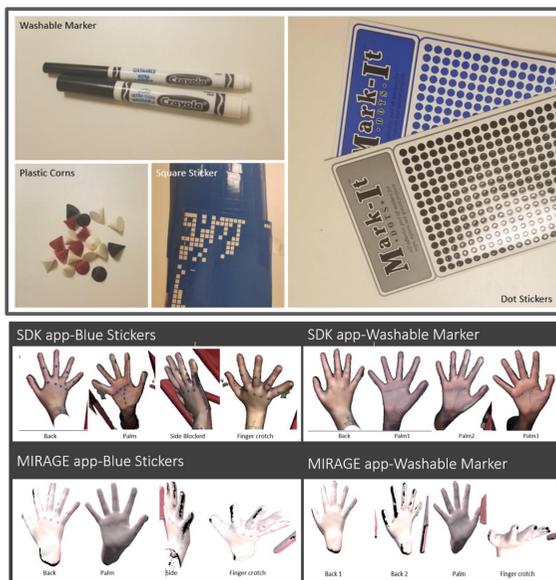
The purpose of this research was to develop a repeatable scanning protocol for the 3D scanning of hands and feet for a large anthropometric study, minimize user error, increase speed and scanning efficiency, and develop best practices to enable collaboration across multiple scanning sites. This research consisted of testing different landmark placements and tools, and the development and testing of stability/scanning platforms for the hand and foot.

## METHOD

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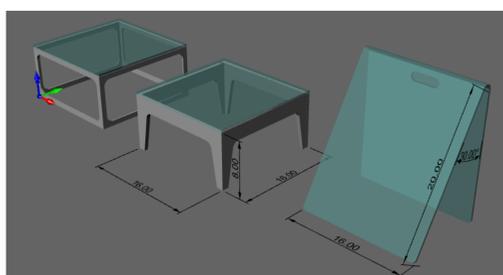
### Landmarks

- Landmarks were tested to determine which landmark tool was visible in the 3D scan and could be used as reference points for measurements and analysis.



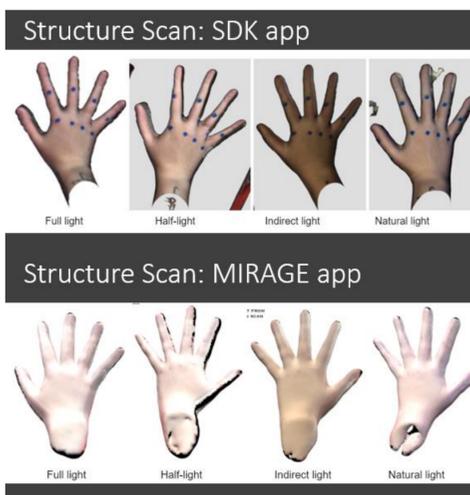
### Platforms and Hand/Foot Position

- Platforms were developed to stabilize the hand and foot during scanning.
- The platforms were tested to ensure accurate hand and foot positioning, and scanning clarity



### Lighting Conditions

- Lighting has a strong effect on the quality of scans.
- Different light sources were tested to understand how to maximize the scan quality when on site visits.



## RESULTS

Scans were analyzed based on clarity of scan and landmarks, anatomical placement of hand and foot on the structures, ability to extract reliable measurements from the landmarks and examine cross-sections of the form, and the ability to efficiently and accurately apply landmarks. The outcomes of the research were the selection of appropriate stabilizing frames for scanning, landmark tools, and landmark locations for the hand and foot.

Because the Structure Scanner is portable, it enables the researchers to collaborate across numerous sites and reach diverse populations of product users. Best practice videos are being produced to teach other sites how and where to place landmarks, and how to scan the hand and foot using the Structure Scanner and stabilizing frames. By standardizing methods and protocols, new technology is being employed in a national 3D anthropometric survey of male and female firefighters. These methods can be adopted to collect human body data across diverse populations

## NATIONAL 3D SURVEY OF FIREFIGHTERS

Over the next five years, we are conducting a nation-wide anthropometric study of firefighters across the United States that will improve the safety, fit, and performance of gloves, boots, and turnout gear for firefighters who risk their lives every day to protect members of their community.

The researchers in the Human Dimensioning Lab are coordinating and conducting the study with 12 other Universities—from Florida to Hawaii—and we're excited to be able to reach a diverse, underserved population of firefighters, especially women.



Pilot study of anthropometric firefighter survey on Sept., 15, 2017 at Eden Prairie Fire Station.