

Virtual Reality 3D Scanning

Senior Thesis

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Advised by Thomas Funkhouser

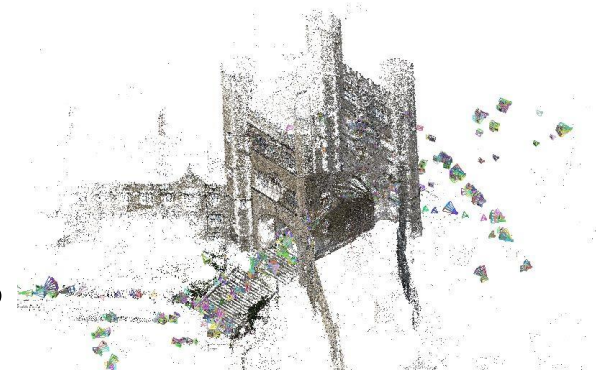
3d scanning

- Collect data on real-world 3d shape, material
- Could be object, person, environment, ...



Motivation

- 3d scanning is useful:
 - **Visualization:** online catalog, tourism, tour monuments for **education**
 - **Entertainment:** characters, environments for **games, movies**
 - **Inspection:** compare to ideal models
 - **Replication:** scaling, restoration



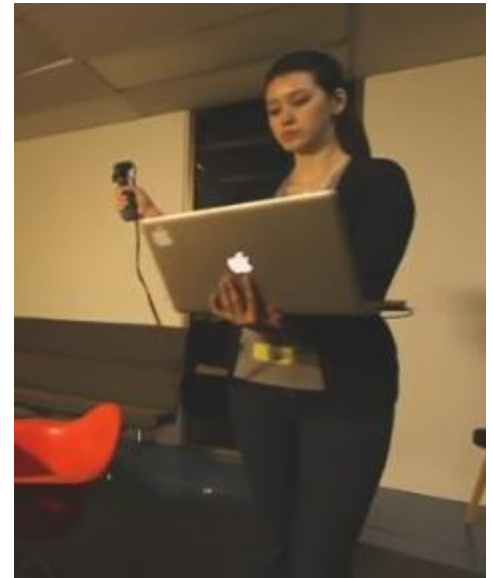
Blair Arch



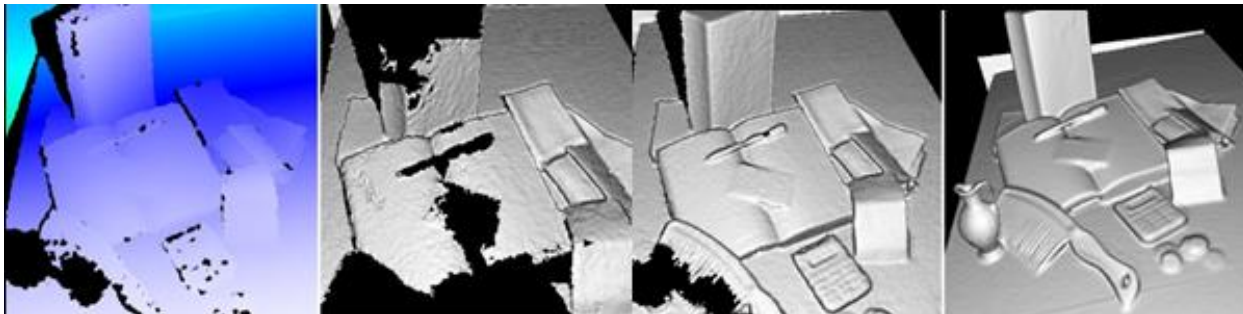
Lincoln Memorial

Problem

- 3d scanning is tricky:
 - **Holes**: crevices, under objects etc.
 - Devices **clumsy** to use
 - Need real-time **feedback**



“Matterport” scanner



Holes in Kinect scans

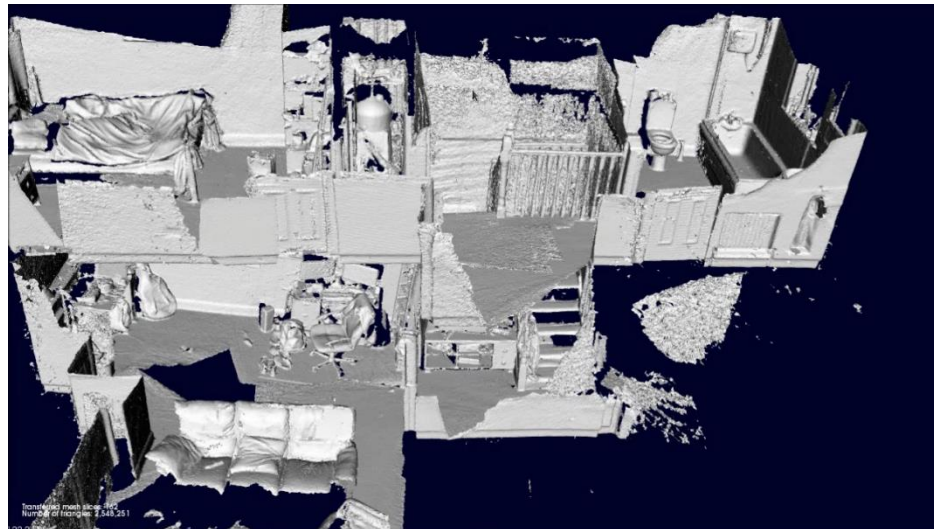
Idea

- **Head mounted scanner, VR + depth camera**
- Show **real-time preview** while scanning
- **Look around** to direct scanner



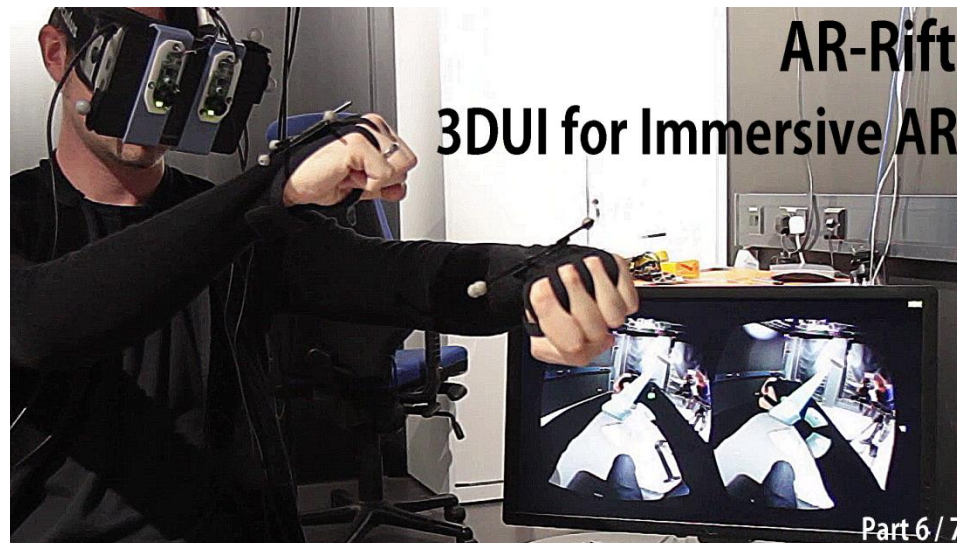
Background

- Lots of reserach **separately** in VR, 3d scanning
 - Scanning: "[Kintinuuous](#): Spatially Extended KinectFusion" by T. Whelan, M. Kaess, M.F. Fallon, H. Johannsson, J.J. Leonard and J.B. McDonald: can scan large environments



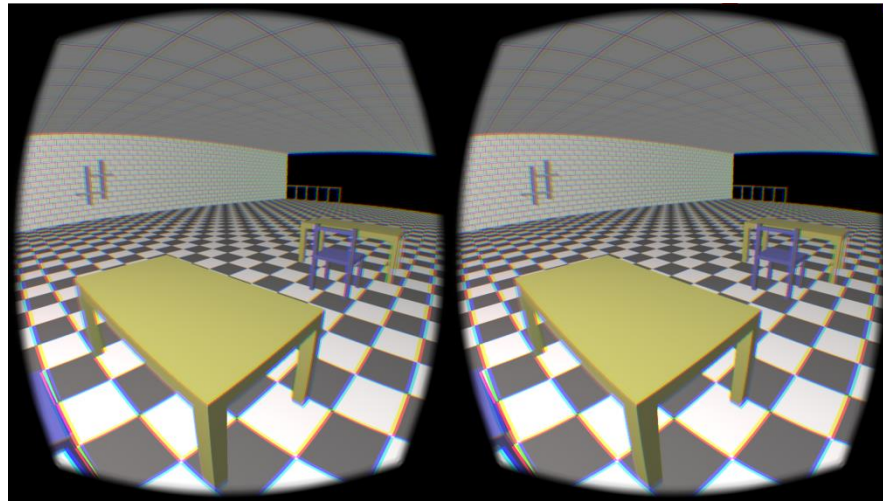
Background

- Lots of reserach **separately** in VR, 3d scanning
 - Oculus + video: "**AR-Rift**" by William Steptoe:
capture video, display in Oculus for 'see-through,'
tracks hand markers



Progress

- Acquired **Oculus Rift** hardware
- **Compiled, tested basic scene with head tracking** with Oculus C API



- Acquired prototype **Intel depth camera** (haven't tested API yet)

Plan/Goals

- Short term (~1 month):
 - Get **depth camera API** working
 - Develop **VR point cloud viewer**
- This semester:
 - Integrate depth camera, Oculus APIs
 - **Mount depth camera** on Oculus
 - Integrate Oculus **motion tracking** with depth data
- Next semester:
 - Deal with **latency** issues
 - Try **real-time video** overlay?
 - **Extended motion** tracking (beyond desk)?

Picture sources

- <http://mep.trimble.com/services/3d-laser-scanning-service>
- http://www.dirdim.com/lm_everything.htm
- Bair Arch scan by David Dohan, 2015
- <http://msdn.microsoft.com/en-us/library/dn188670.aspx>
- <http://www.gizmag.com/matterport-3d-scanner/22118/>
- <https://www.oculus.com/order/>
- <http://www.fabbaloo.com/blog/2013/9/7/expect-superior-3d-depth-cameras-in-2014.html>