

Kinect - Concepts and Research Opportunities

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Administrivia

- Motivation
 - Informal, interdisciplinary gathering for researchers who are interested in applying HCI techniques
 - Be aware of big ideas or important research techniques out of one's current research direction
- Mailing list
 - hci-reading-group-at-pitt@googlegroups.com
- Wiki (please contribute)
 - http://mips.cs.pitt.edu/internal/HCI_Reading_Group
- No meeting next week (Thanksgiving). Will have the last meeting in this semester on 12/2/2010.



Outline

- Introduction to Kinect
- Working Mechanism
- Emerging Usage Scenarios
- LighSpace and DepthTouch
- Discussions

Introduction

- Kinect (code name *Project Natal*) is a “controller-free gaming and entertainment experience” by Microsoft for the Xbox 360 platform
- Launched on 11/4/2010 in North America at USD \$150 MSRP.
- Sold 1M units in 10 days in the U.S.
- Open source drivers for Linux, Mac, PC appeared a few days after the launch date

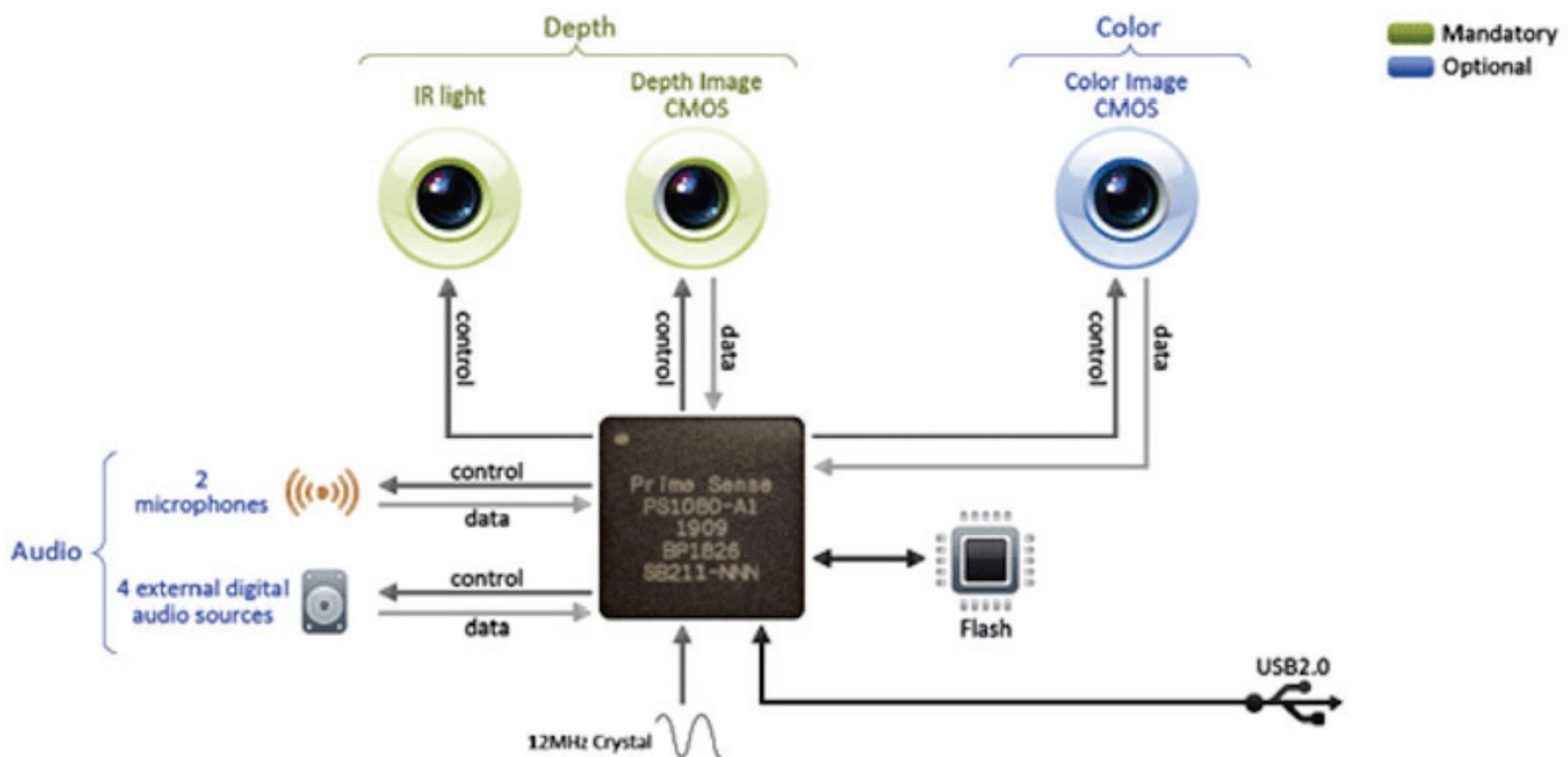


How Does It Work?

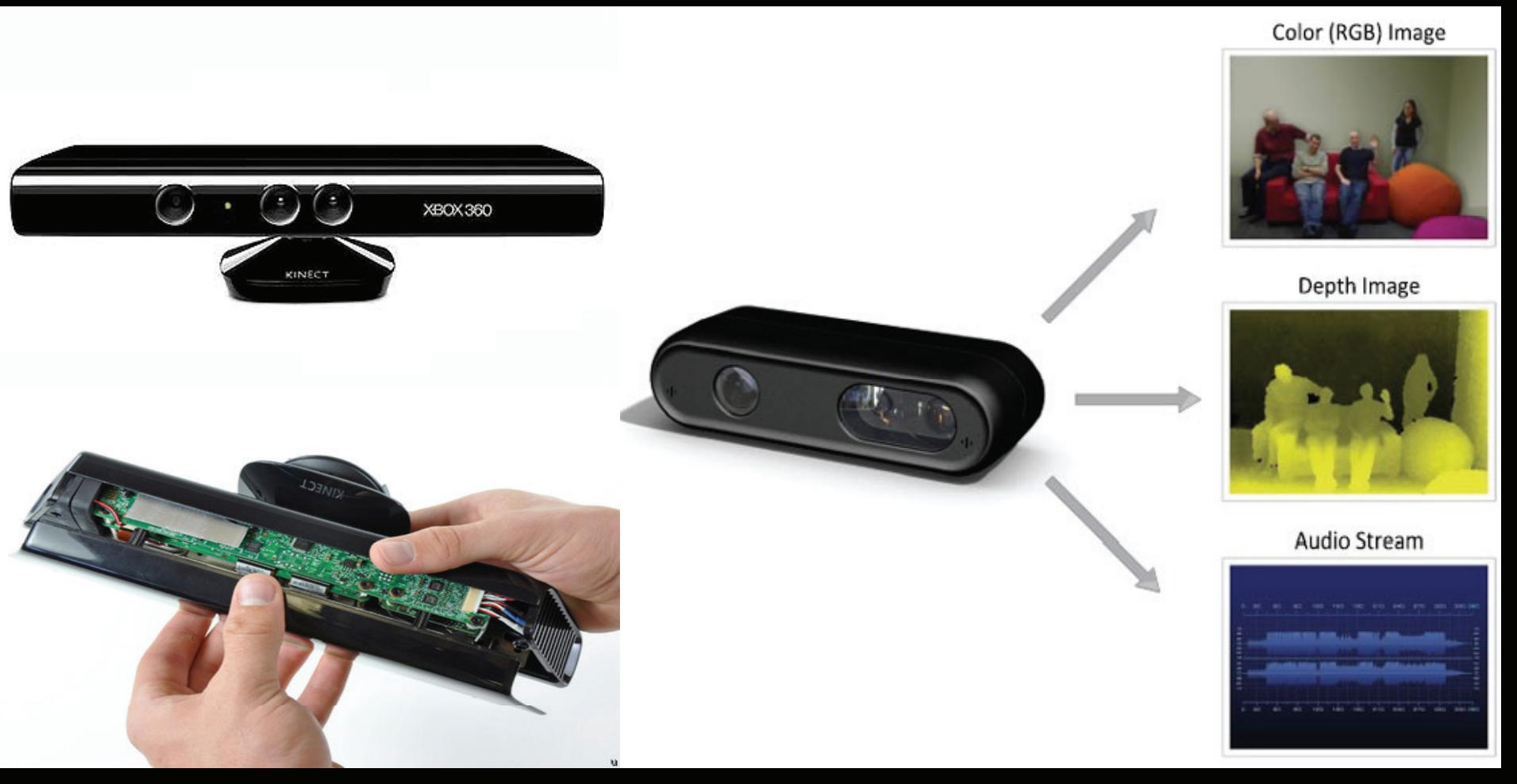
- The Kinect hardware is a combination of
 - An RGB camera,
 - A depth sensor
 - A multi-array microphone



ifixit



Kinect and PrimeSense

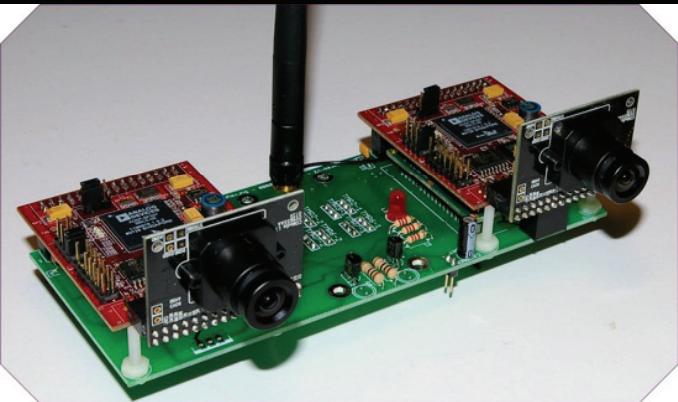


Depth Sensing Technologies

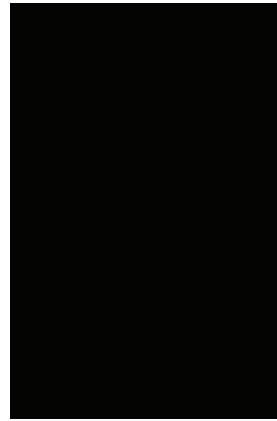
- Stereo vision
- Time-of-flight Camera (3DV, Canesta)*
- Structured Lighting (PrimeSense, Kinect)

* Microsoft acquired 3DV early this year and acquired Canesta last month.

Stereo Vision



Time of Flight Camera

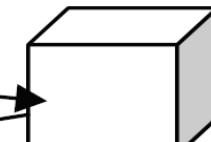


Light source $s(t) = \sin(2\pi f_m t)$

source

Lens

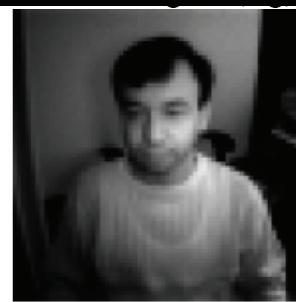
Sensor



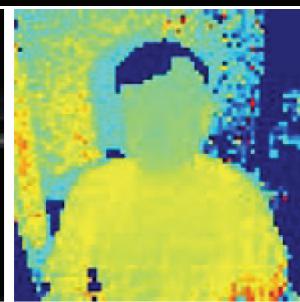
Target

d

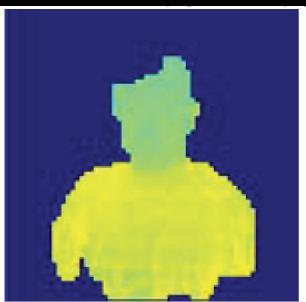
Received light: $r(t) = R \sin(2\pi f_m t - \phi)$



(a)



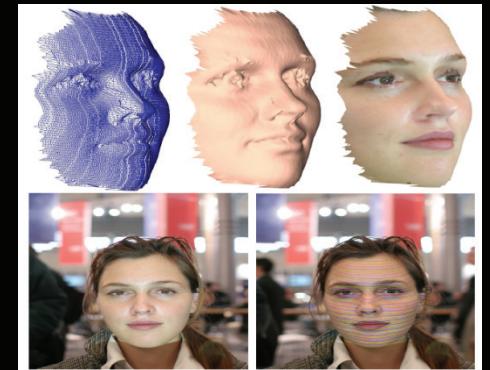
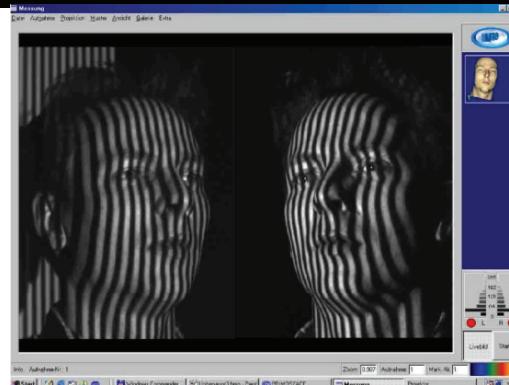
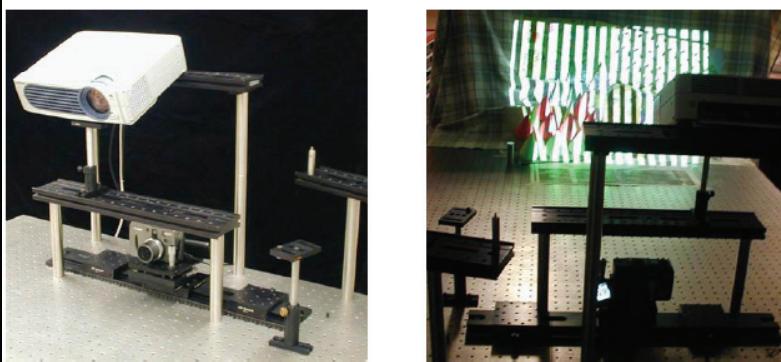
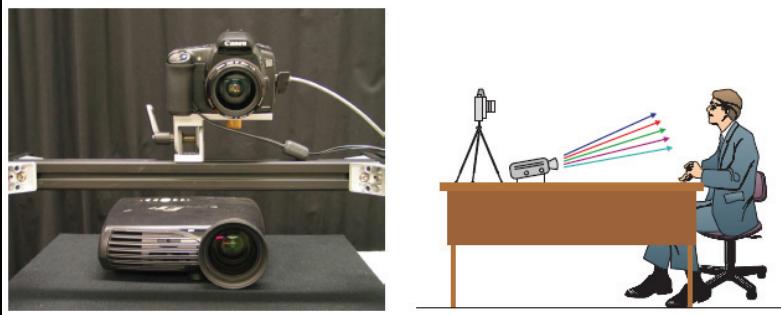
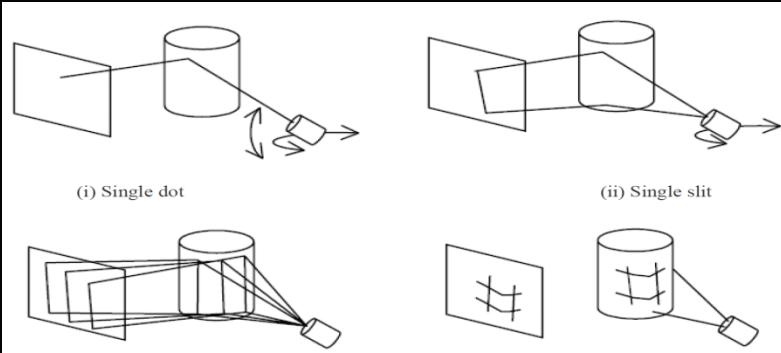
(b)



(c)

Figure 14. (a) Brightness image. (b) Range image. (c) Range image after ambient cancellation filtering.

Structured Lighting



<http://www.youtube.com/watch?v=CEep7x-Z4wY>

http://www.youtube.com/watch?v=XgrGjJUBF_I

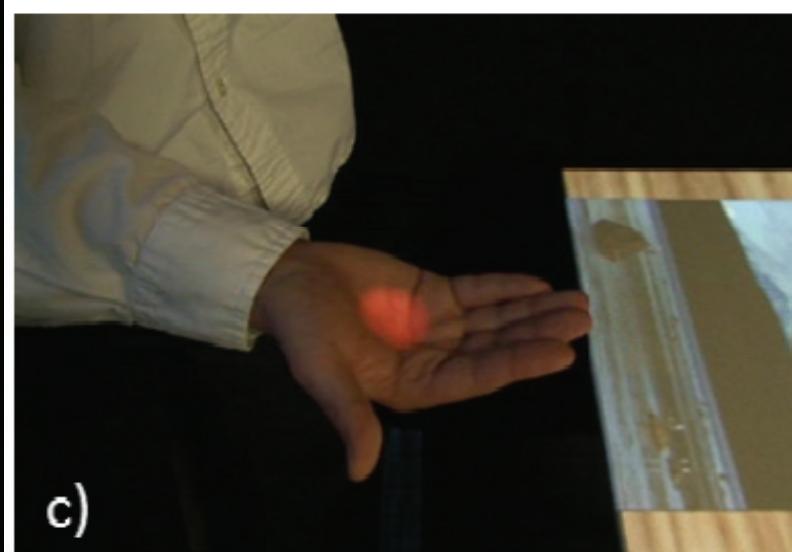
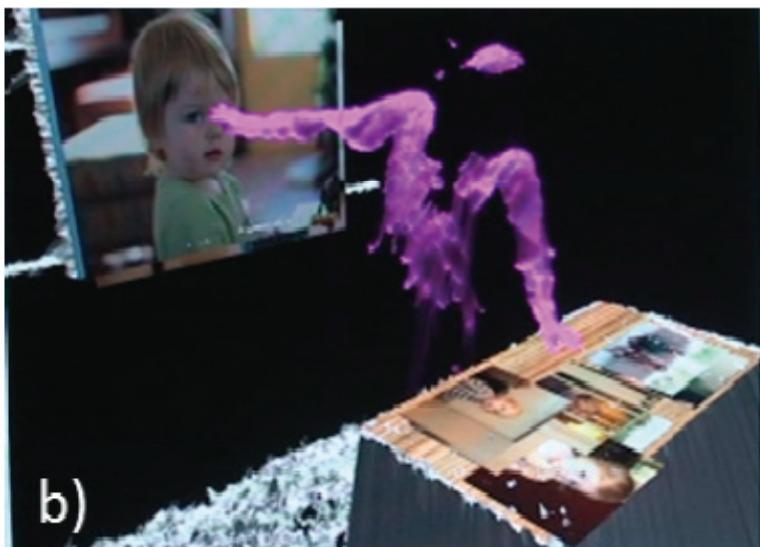
Opportunities from Kinect

- Although depth camera is not new, Kinect brings this technology to mainstream at an affordable price (TOF cameras cost \$1.5k+ most of the time).
- Open source drivers have been created to make Kinect work on Windows/Linux/Mac
- What could happen when we have such a device in our office, work space or home?

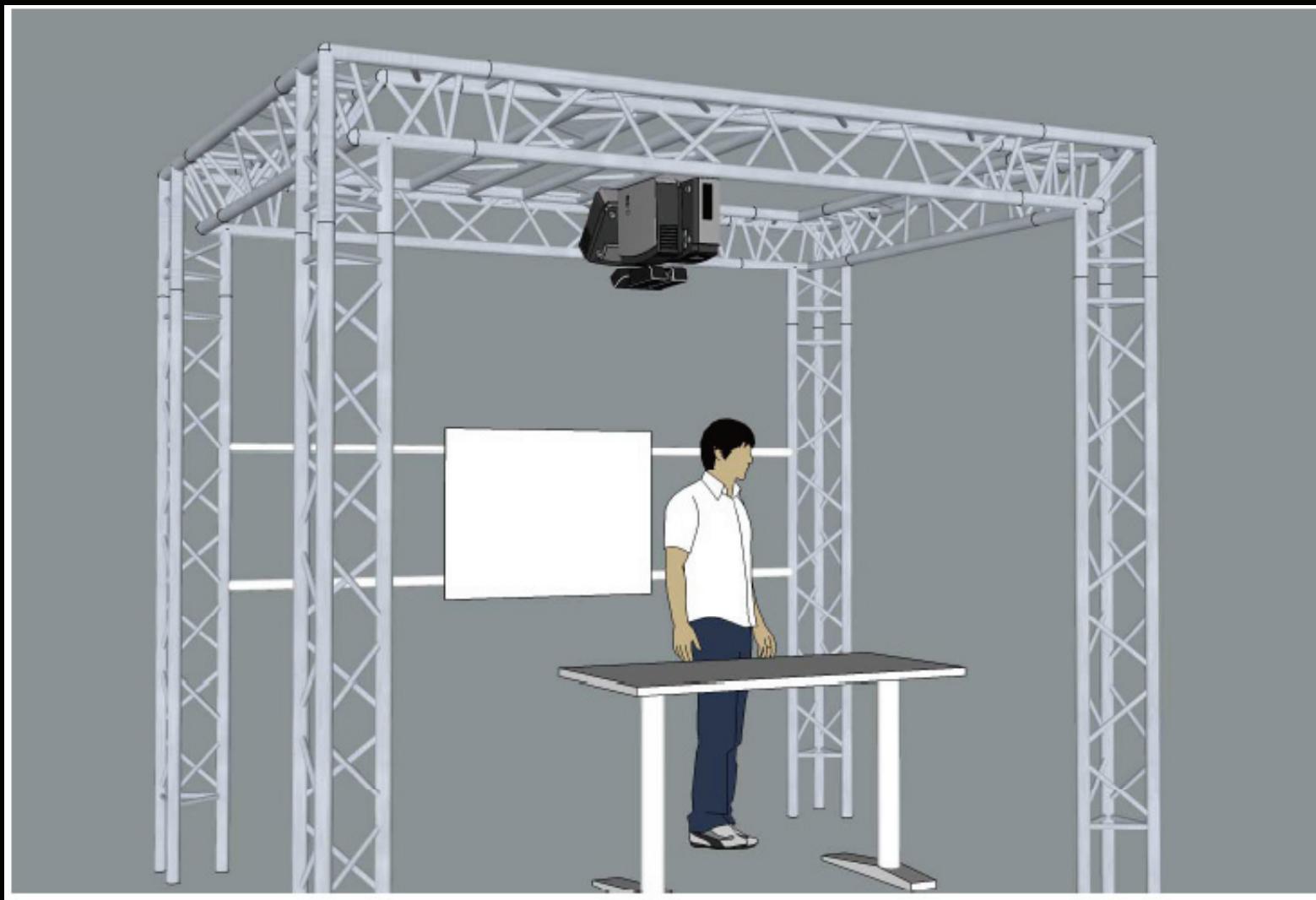
Some Demos

- Driver demonstration
 - <http://vimeo.com/16734124>
 - <http://www.youtube.com/watch?v=jQgnupBUI4>
- Drawing in 3D
 - <http://vimeo.com/16818988>
- Multi-touch
 - <http://www.youtube.com/watch?v=ho6Yhz21BJI>
 - <http://www.youtube.com/watch?v=Bth0TkRLVtk>
- 3D Tracking
 - <http://www.youtube.com/watch?v=Q1heqFVrQGU>
- 3D Video capture
 - <http://www.youtube.com/watch?v=7QrnwoO1-8A>
- 3D UI based on head tracking
 - http://www.youtube.com/watch?v=Y-f_oMOvNAk
- Controlling Robots
 - <http://www.youtube.com/watch?v=dRPEns8MS2o>

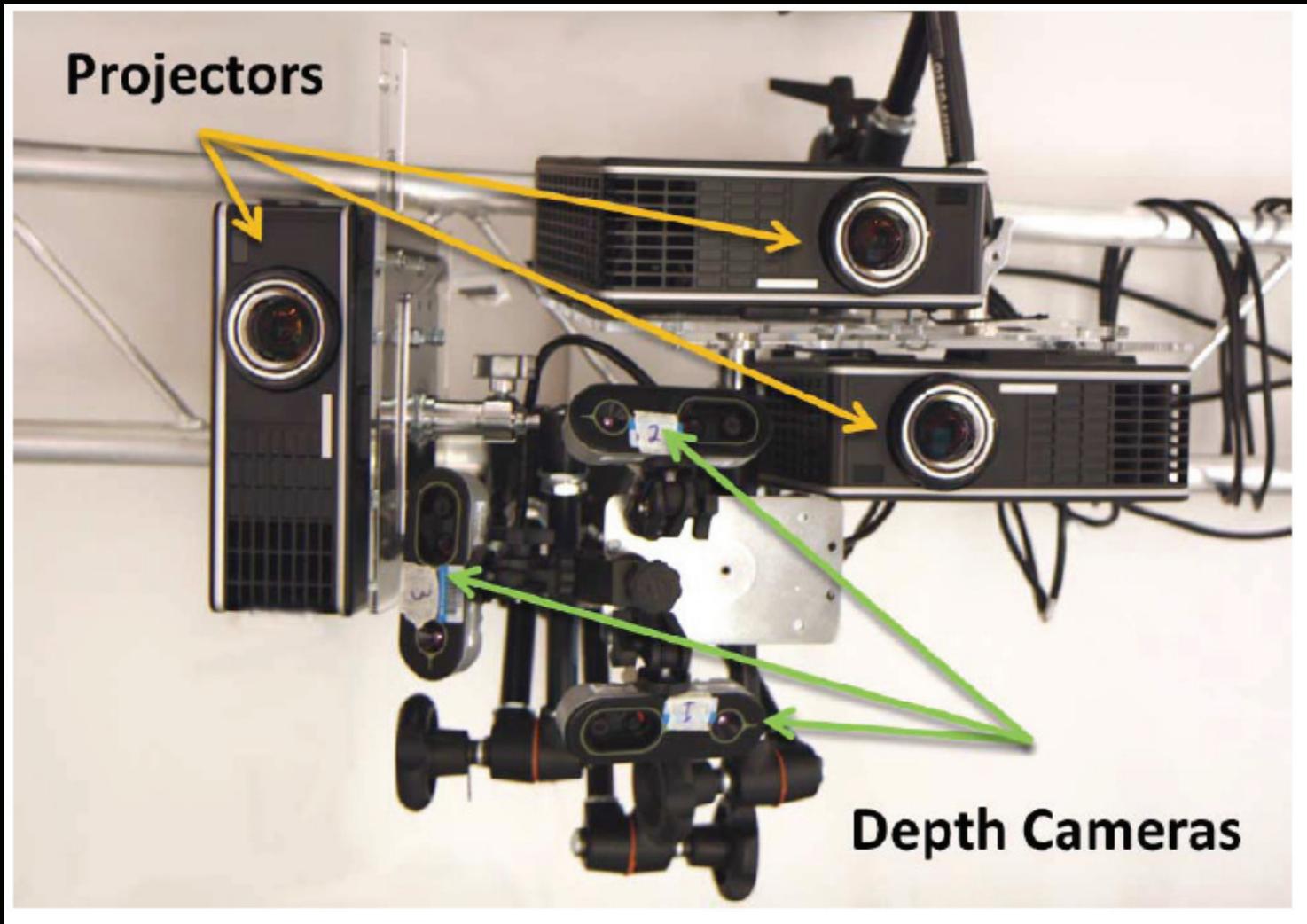
LightSpace – Depth Camera + Projector



LightSpace - Configuration



LightSpace - Configuration



Research Opportunities?

- New Interaction Techniques?
- Domain Specific Applications? (Training, Health care, Surveillance, Robotics)
- Augmented Reality
- In the classroom, for education purposes?
- In the office, working space?
- Online Shopping, remote collaboration?