Depth Sensors

WS 2014-15 Intelligent Robotics Seminar
by Savitha Nagaraju

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- Why Depth Sensors?
- Techniques in Depth Sensors
- Types Of Depth Sensors
- Application Of Kinect Depth Sensors
- Summary

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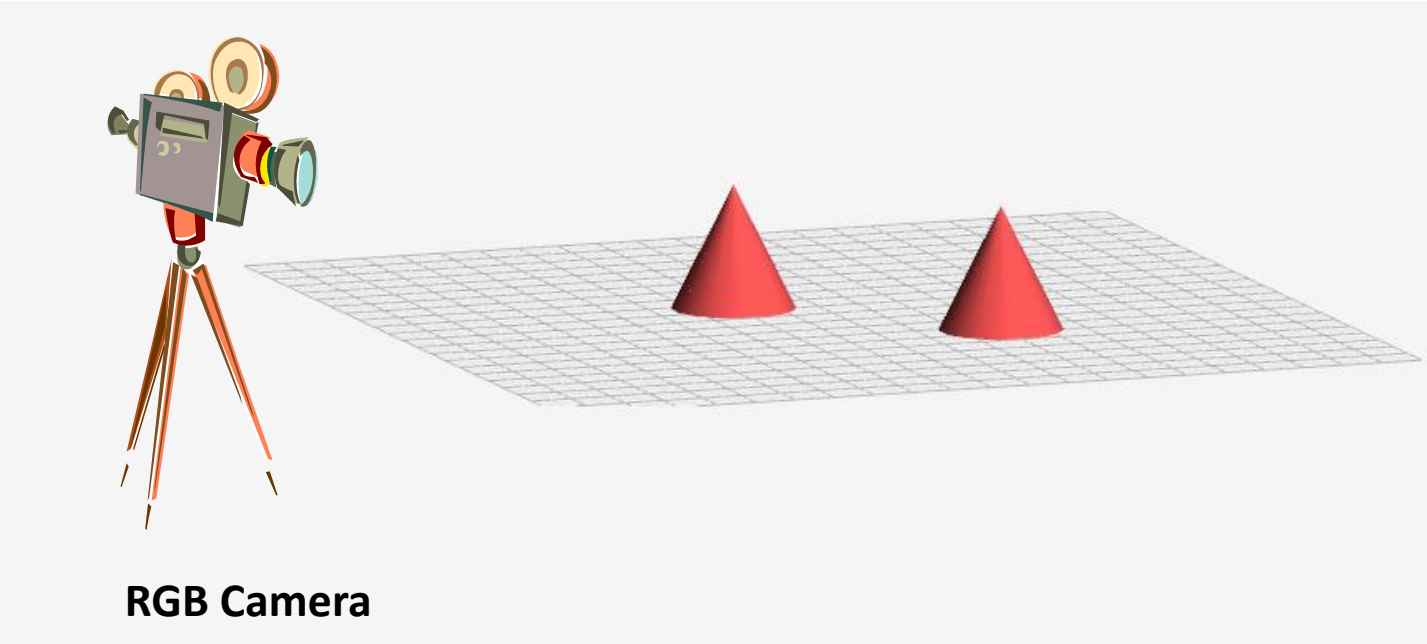
Why Depth Sensors?



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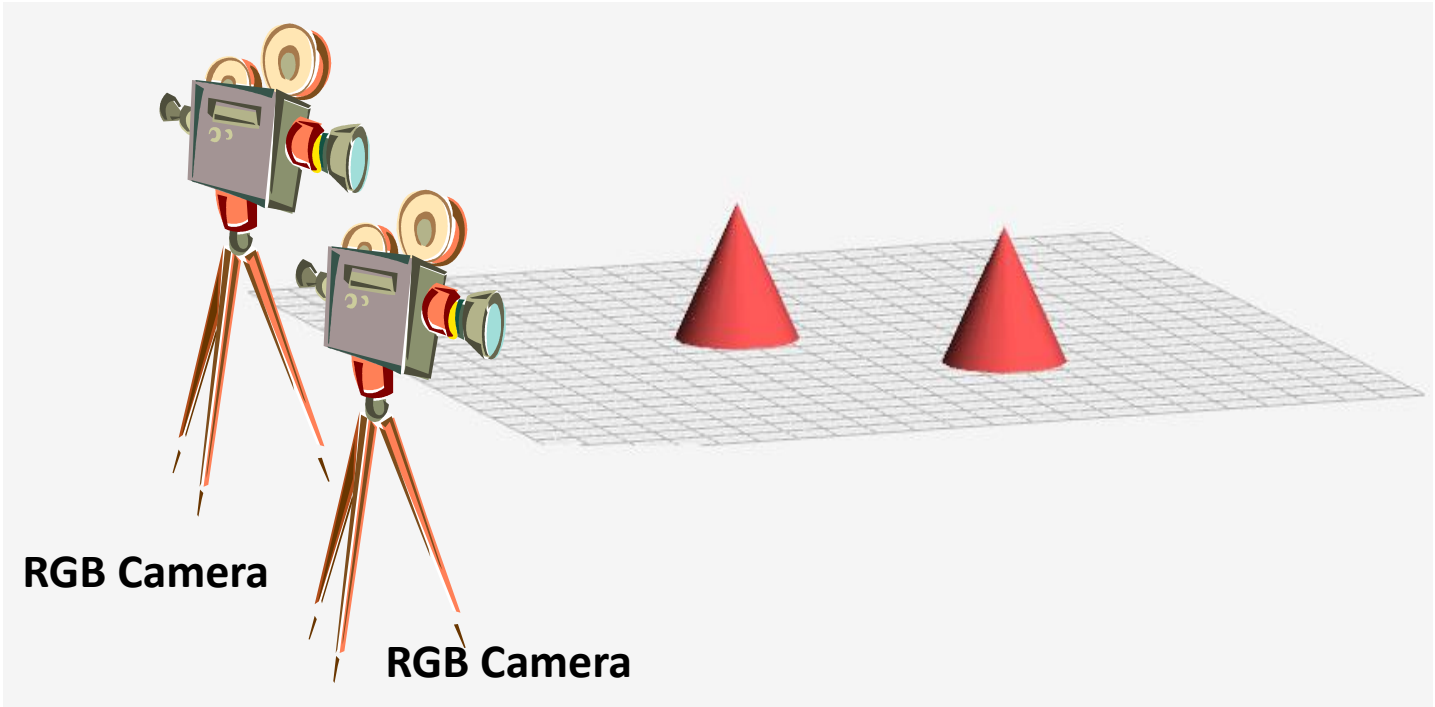

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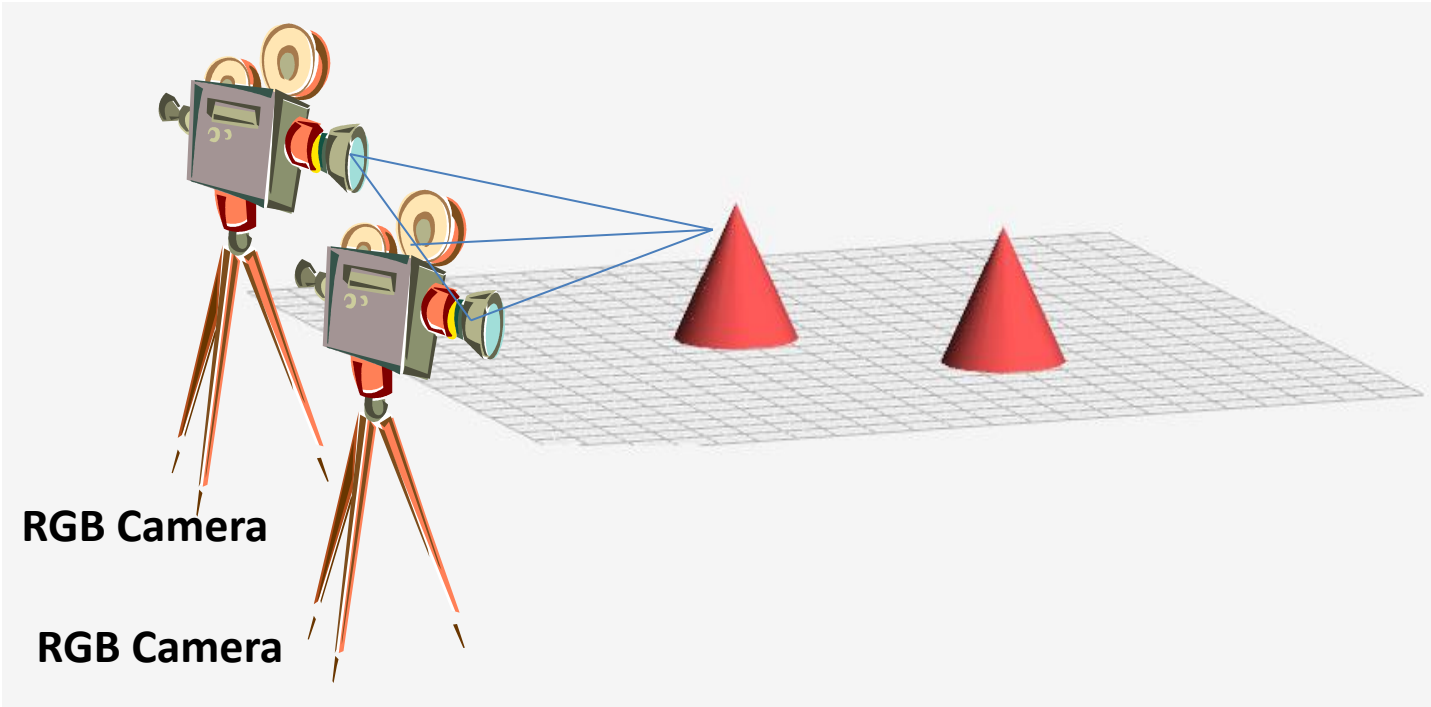

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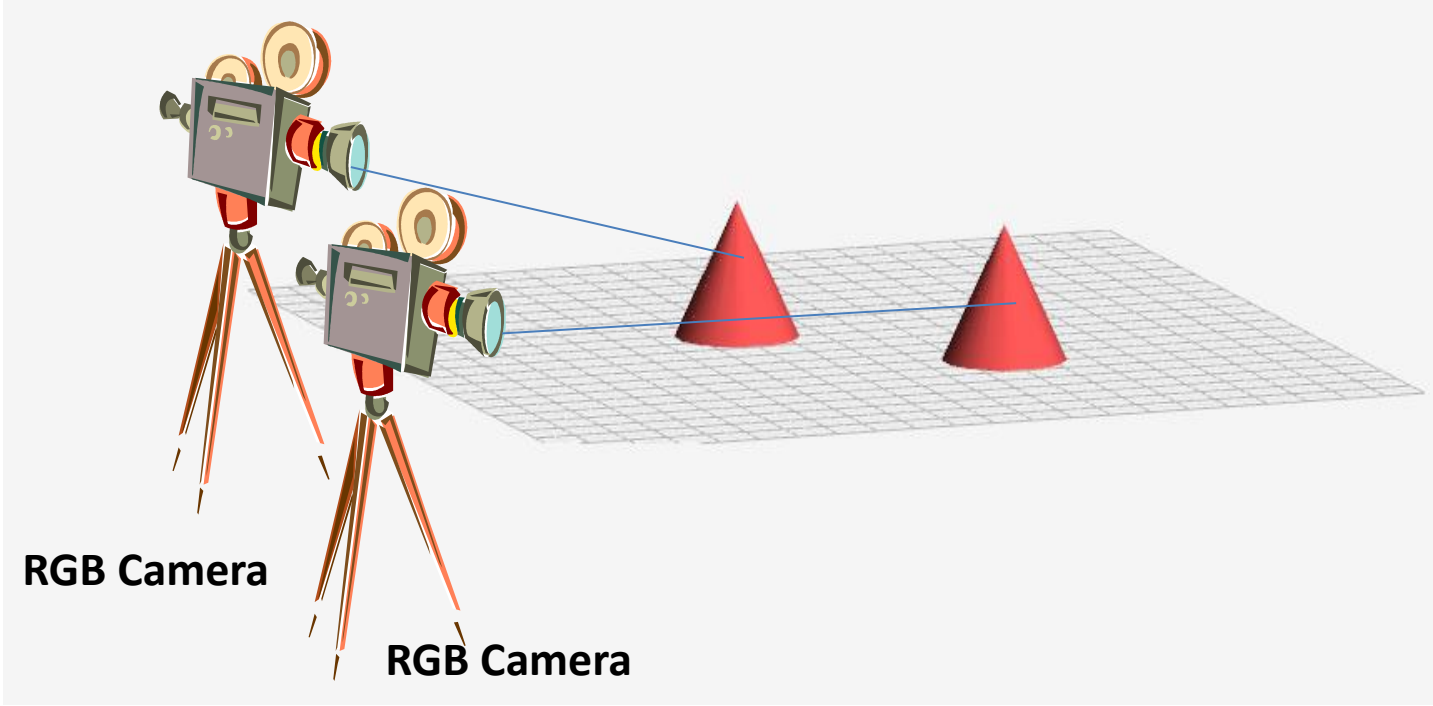

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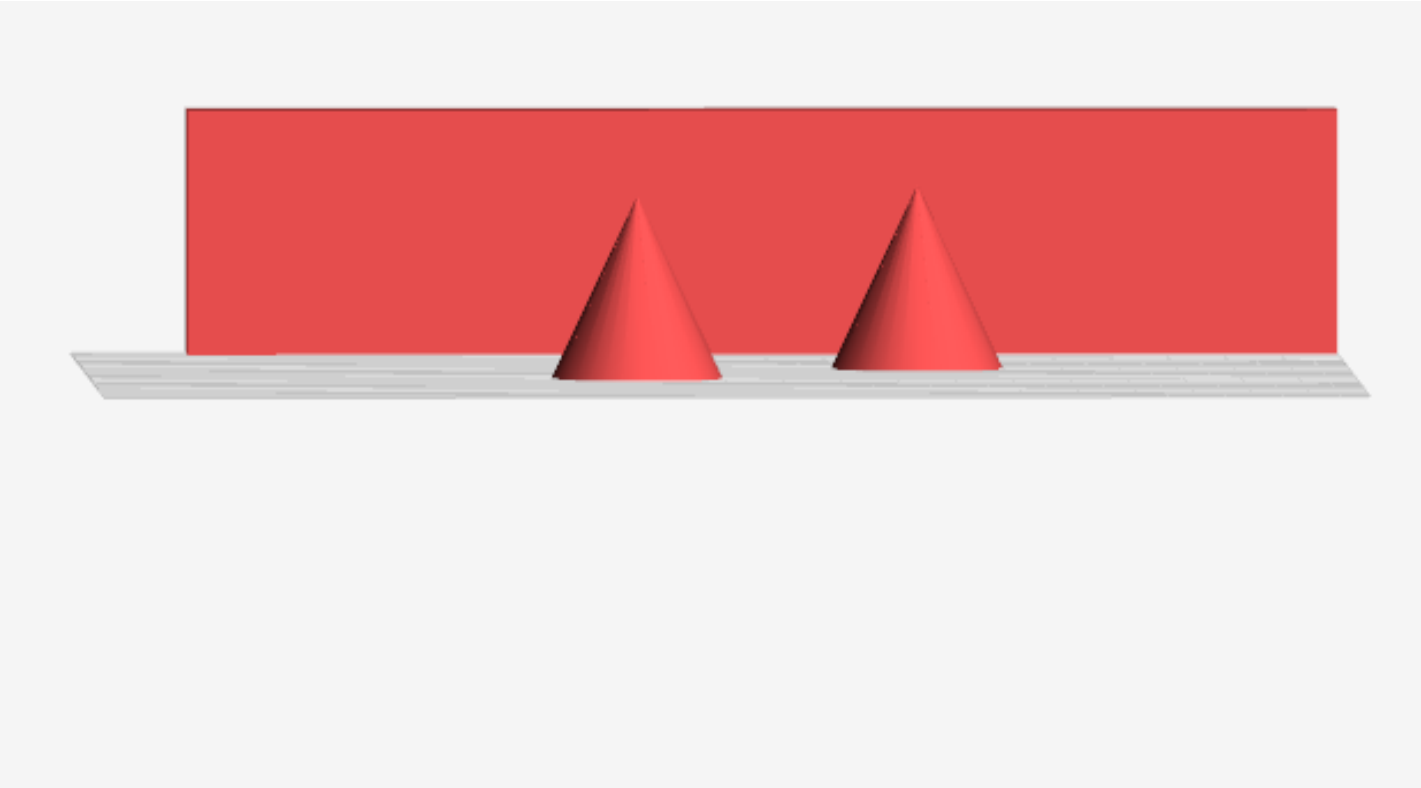

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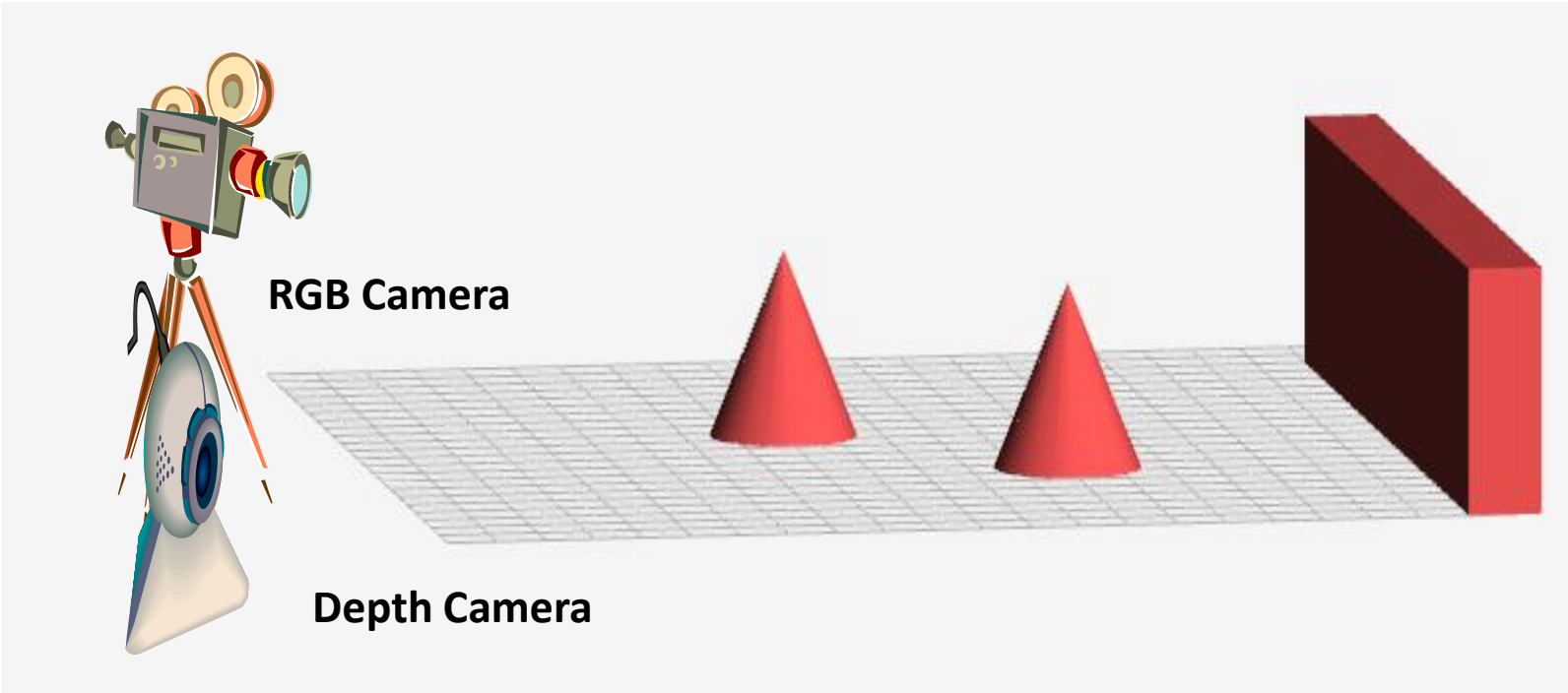

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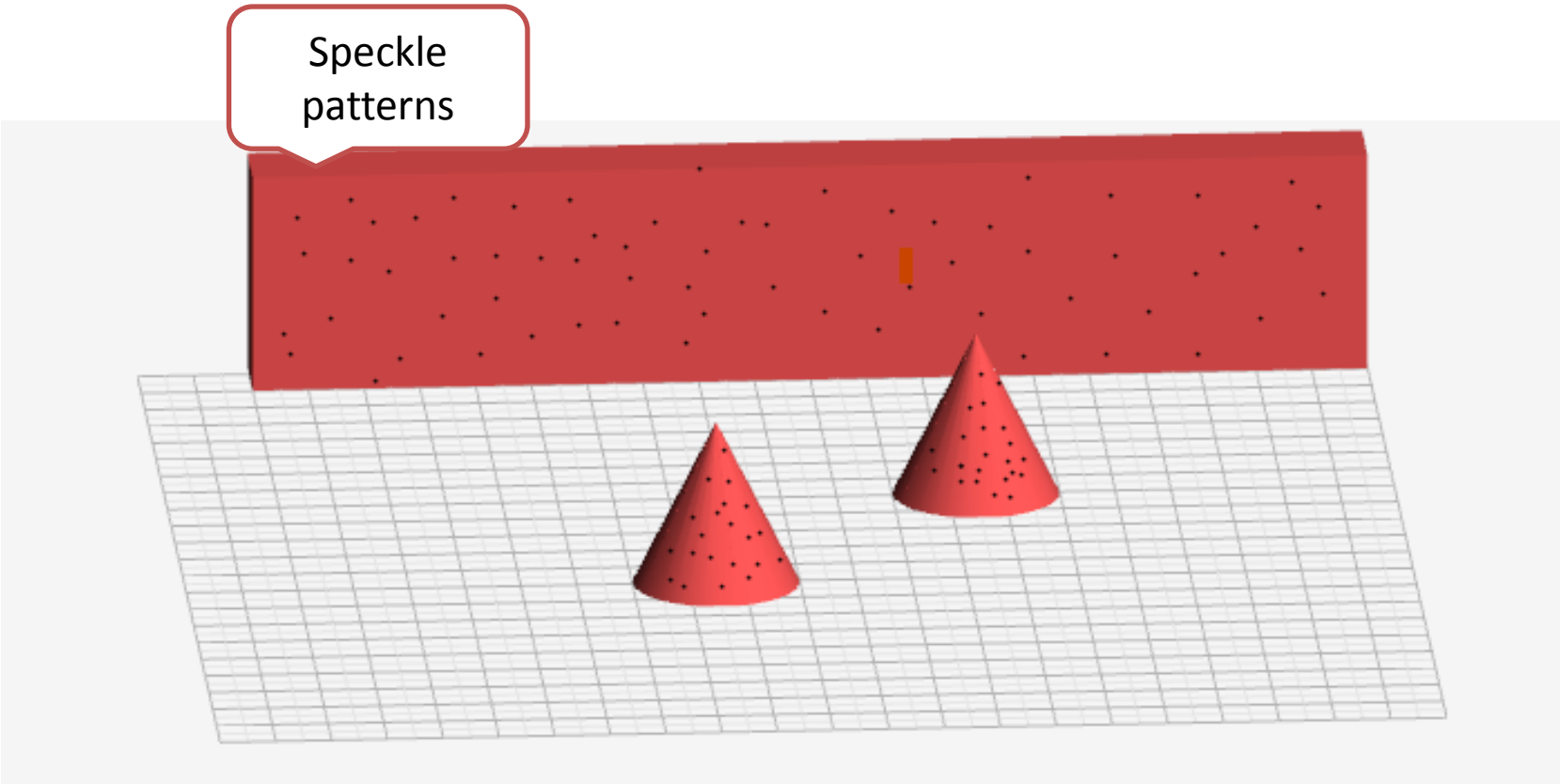

Why Depth Sensors?

Source : http://learning.codasign.com/index.php?title=Drawing_Depth_with_the_Kinect

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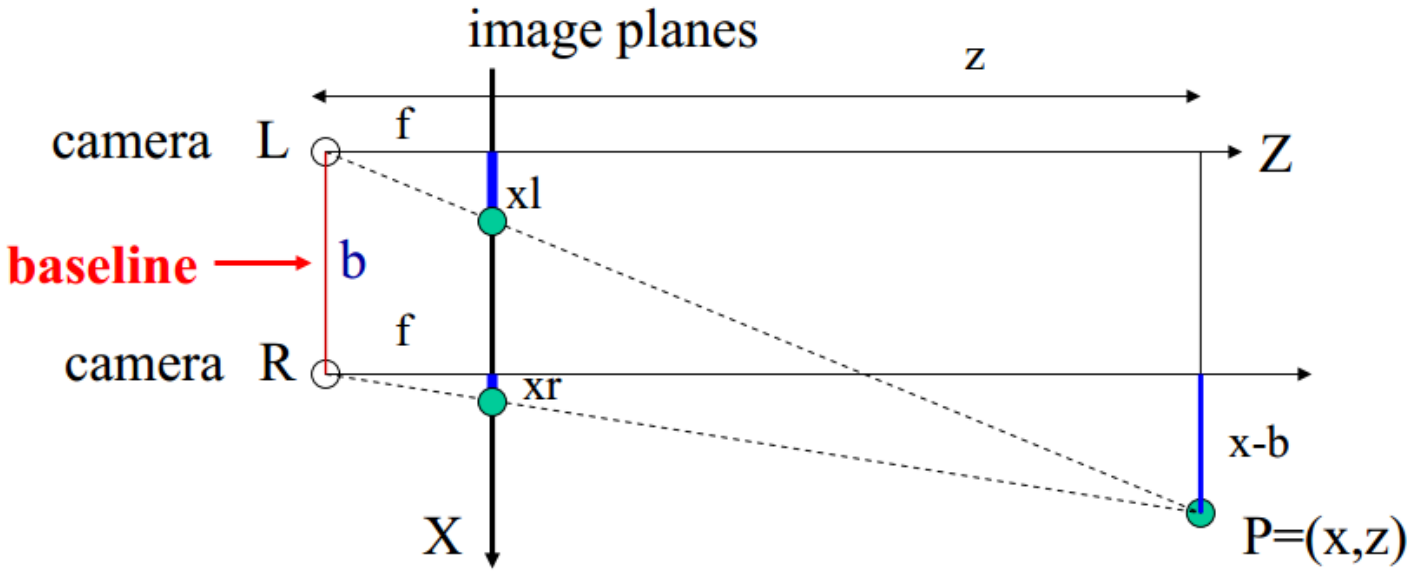
Techniques in Depth Sensors

- Stereo Triangulation
- Time Of Flight
- Coded Aperture

Techniques in Depth Sensors

Stereo Triangulation



$$\frac{z}{f} = \frac{x}{xl} \qquad \frac{z}{f} = \frac{x-b}{xr} \qquad \frac{z}{f} = \frac{y}{yl} = \frac{y}{yr}$$

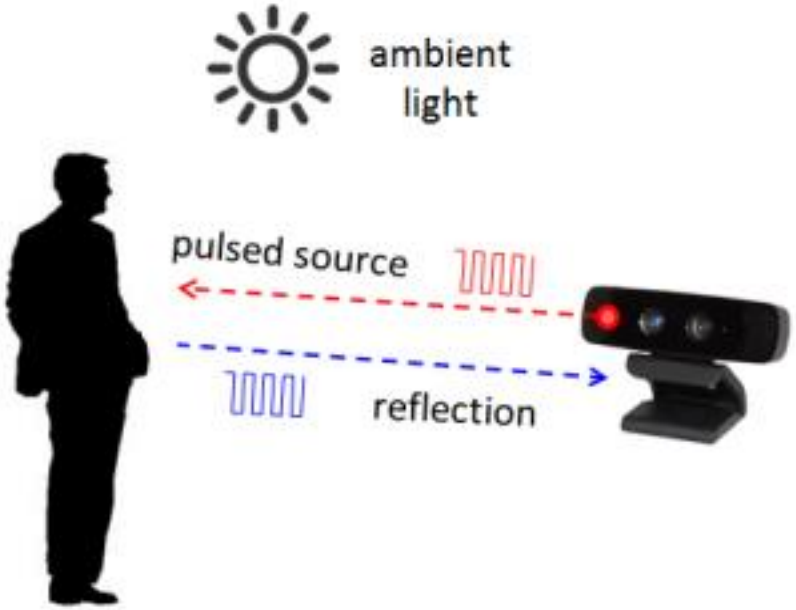
Y-axis is perpendicular to the page.

(from similar triangles)

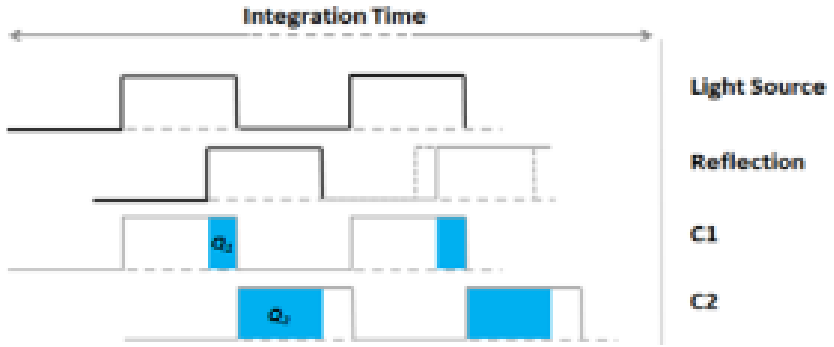
Source:https://courses.cs.washington.edu/courses/cse455/09wi/Lects/lect16.pdf

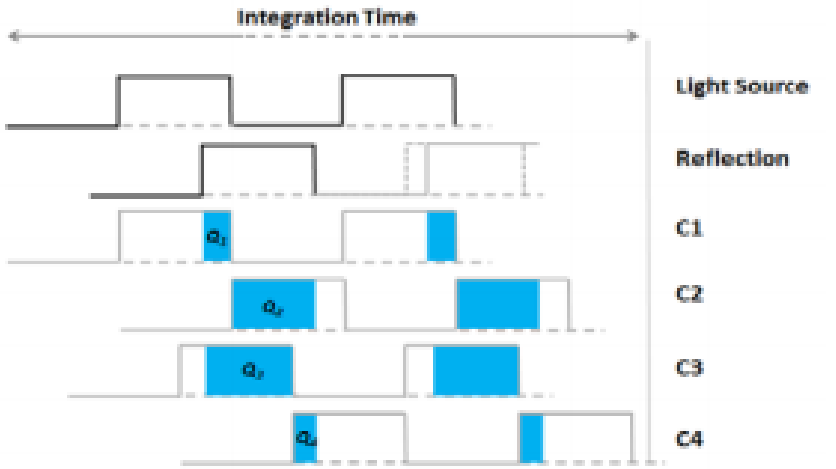
Techniques in Depth Sensors

Time Of Flight



$$d = \frac{1}{2} c \Delta t \left(\frac{Q_2}{Q_1 + Q_2} \right).$$

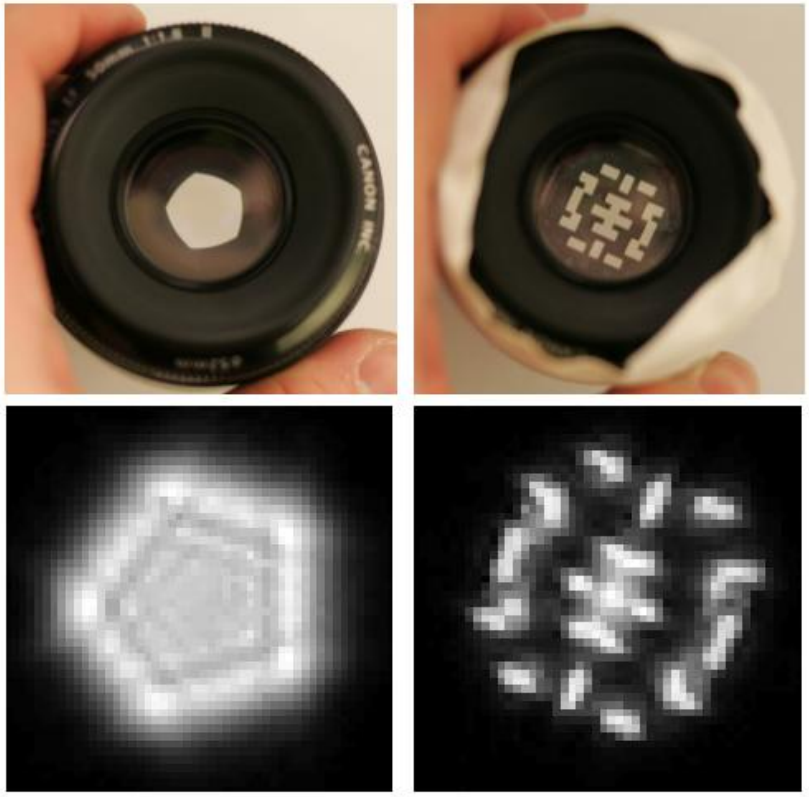




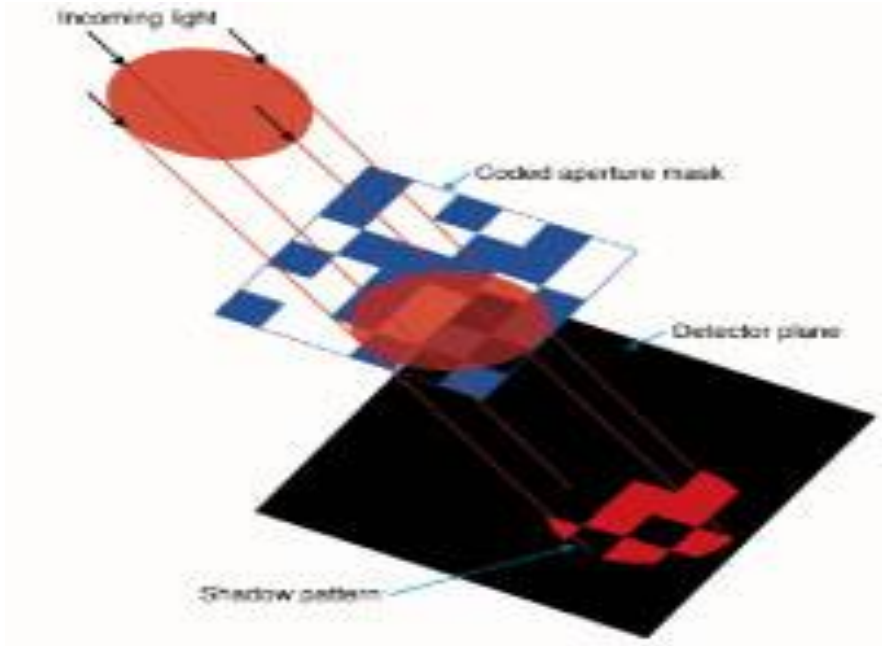
Source :http://www.ti.com/lit/wp/sloa190b/sloa190b.pdf

Techniques in Depth Sensors

Coded Aperture

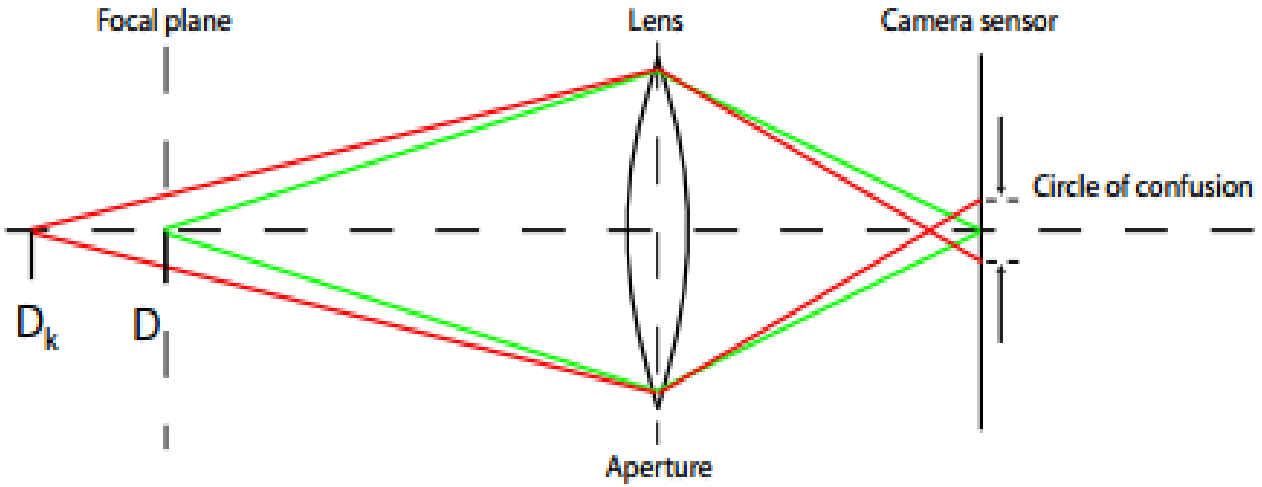


(a) Conventional (b) Coded



Techniques in Depth Sensors

Coded Aperture



Source:**Image and Depth from a Conventional Camera with a Coded Aperture**
Anat Levin, Rob Fergus, Fredo Durand, Bill Freeman
appeared in SIGGRAPH 2007

Techniques in Depth Sensors

Coded Aperture

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Types Of Depth Sensors

- Intel Perceptual Computing
- Leap Motion
- Microsoft Kinect

Types Of Depth Sensors

Intel Perceptual Computing

- Smaller and less expensive
- Close range tracking
- Hand posture
- Facial analysis
- Speech

Types Of Depth Sensors

Leap Motion

- Finger tracking is fast and accurate
- Smaller and less expensive
- Compatible with Mac OS and Windows

Types Of Depth Sensors

Microsoft Kinect

- Most popular among the depth sensors
- It can track 20 joints in human skeleton
- Upto 6 people can be detected and 2 skeletons can be tracked
- Kinect for windows have near mode which can track skeleton in sitting position
- Current version is v2.0

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Application Of Kinect Depth Sensors

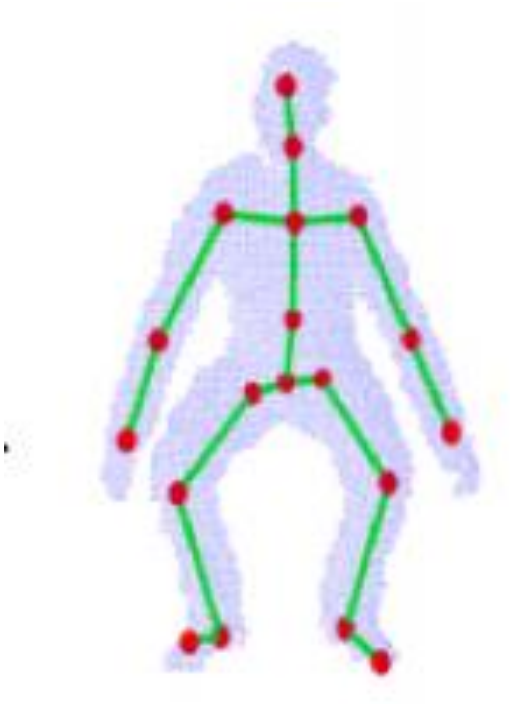
- Object detection and tracking
- Pose Estimation
- Hand Gesture Analysis

Application Of Kinect Depth Sensors

Source:**Enhanced Computer Vision with Microsoft Kinect Sensor: A Review**
Jungong Han, *Member, IEEE,* Ling Shao, *Senior Member, IEEE,* Dong Xu, *Member, IEEE,* and Jamie Shotton, *Member, IEEE*

Application Of Kinect Depth Sensors

Pose Estimation



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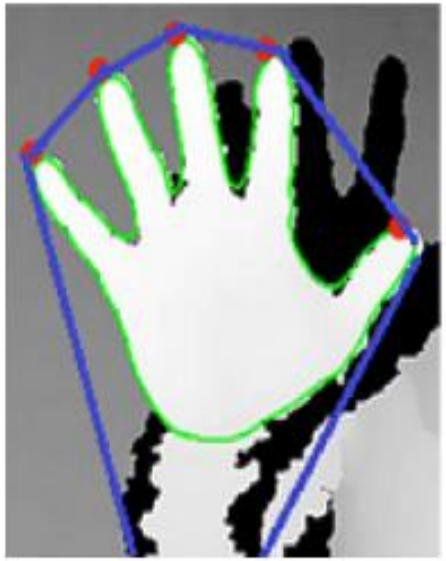
Application Of Kinect Depth Sensors

Hand Gesture Recognition



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- Principle used in Depth Sensors
- Stereo Triangulation, Time of flight, Coded Aperture
- Intel Perceptual Computing, Leap Motion, Microsoft Kinect
- Applications

Questions?