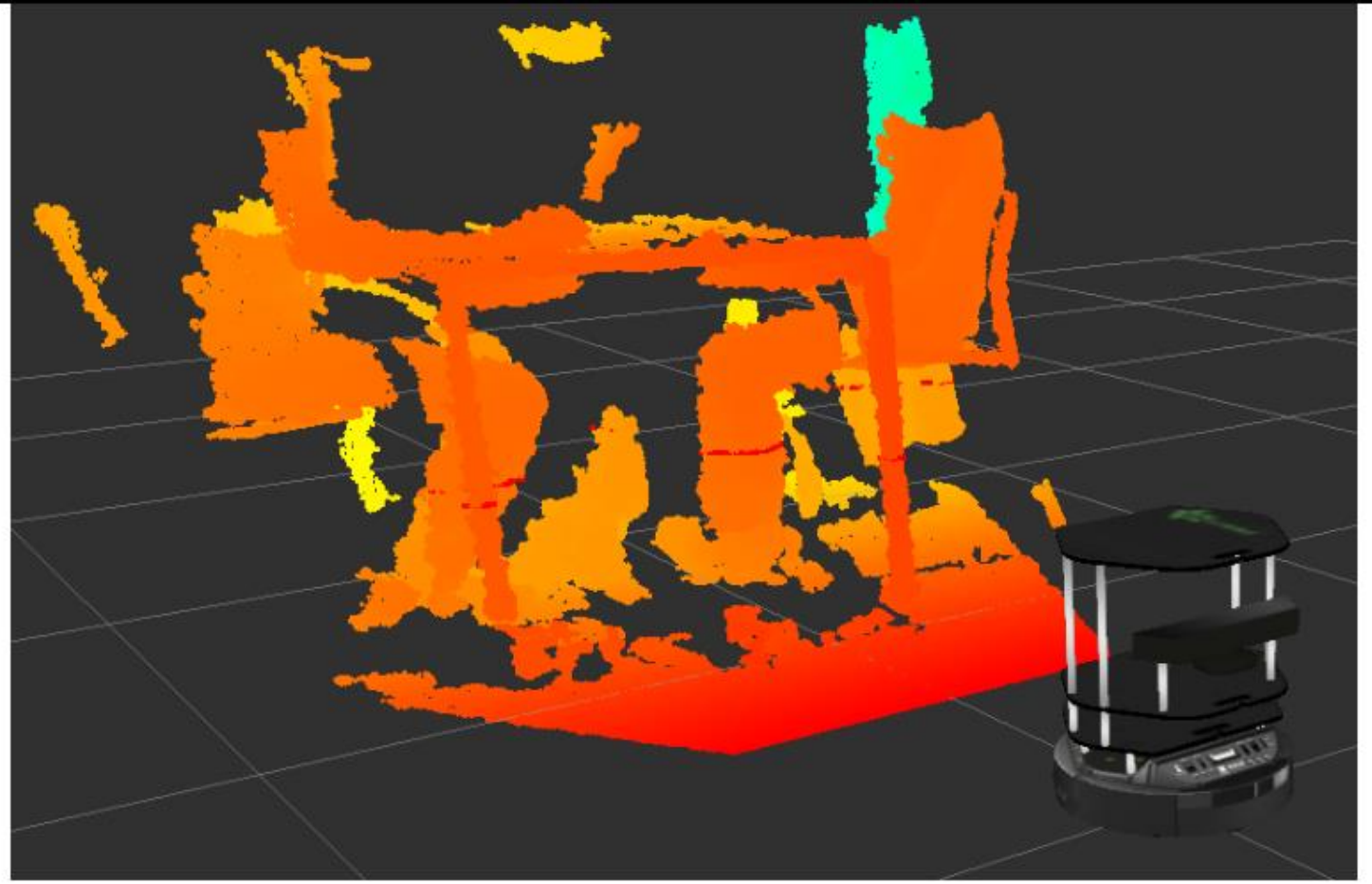
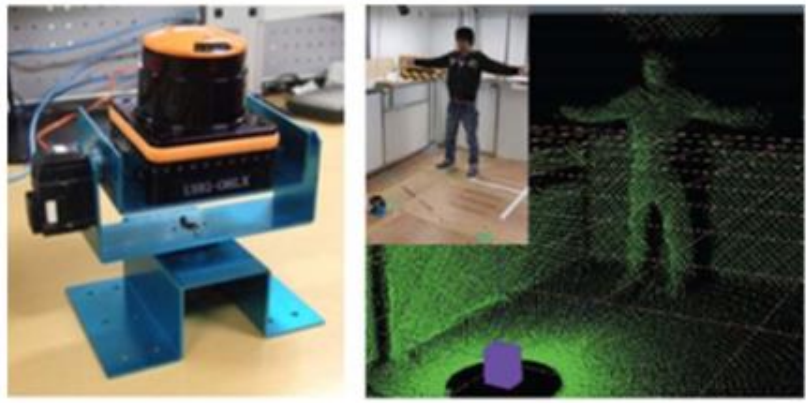


# RGB-D SENSING

# Robot Vision Sensors

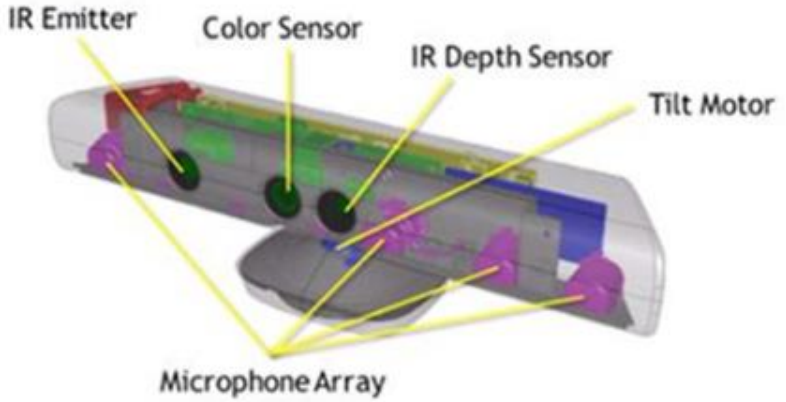
- Optical and camera based systems
- Laser range finder, ultrasonic distance sensor, 3 dimensional range image camera using modulated infrared light, etc.



3D laser range finder


2D laser range finder

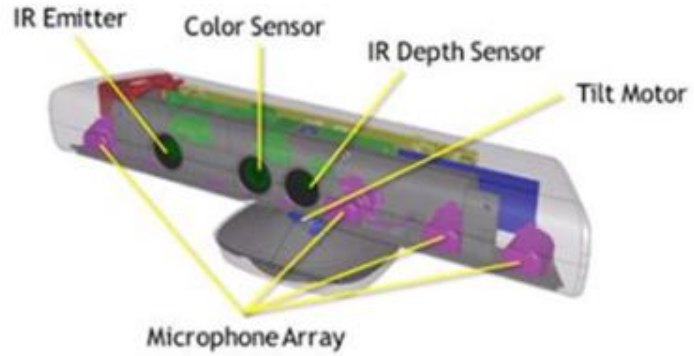

Color camera

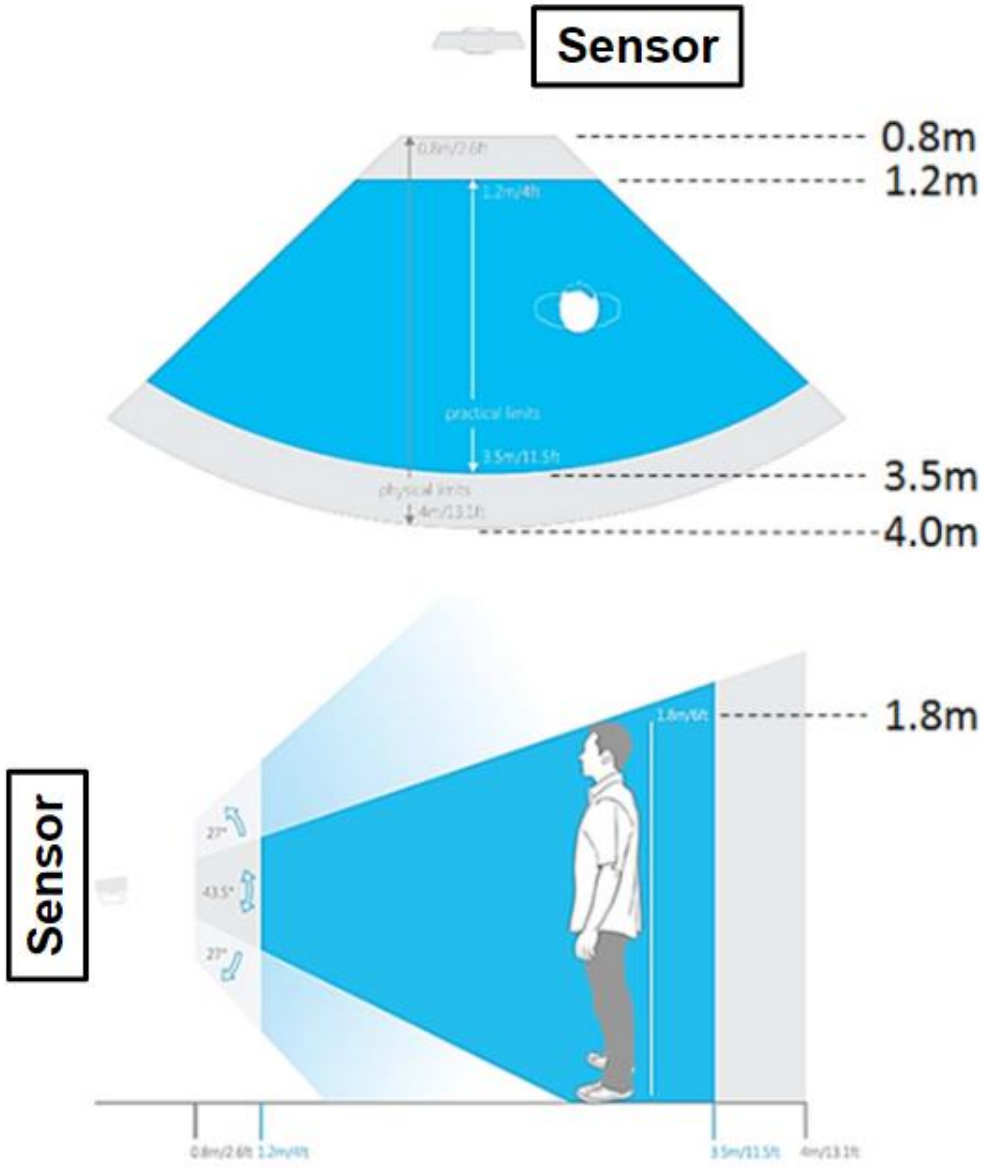



[https://msdn.microsoft.com/en-us/library/jj131033.aspx]

# RGB-D Sensor

- 3D MS Kinect sensor
  - RGB Color VGA Video camera
  - Depth sensor
    - Infrared projector
    - Monochrome CMOS sensor
- Resolution 640 x 480 pixel
- 30 FPS

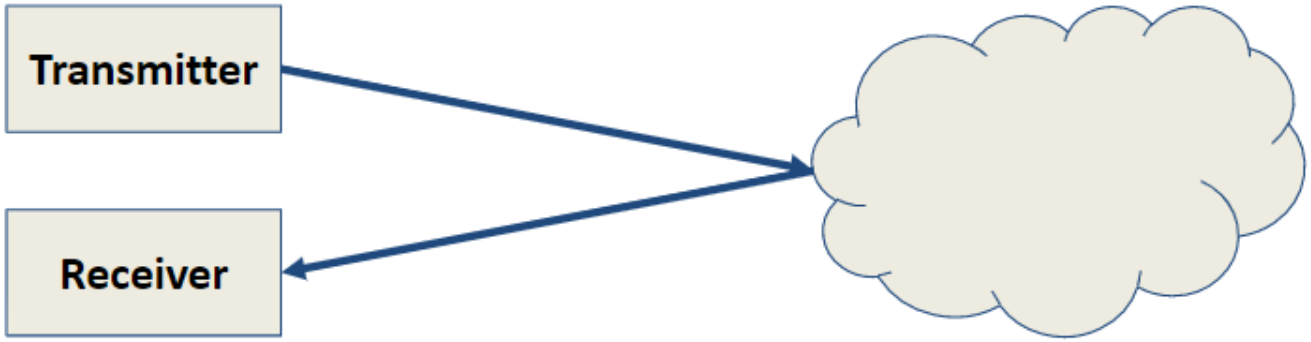


# Distance Sensing

The distance to the object is measured using the time (Time of Flight, TOF) of the laser beam emitted from the transmitter hits the object and returns to the receiver.

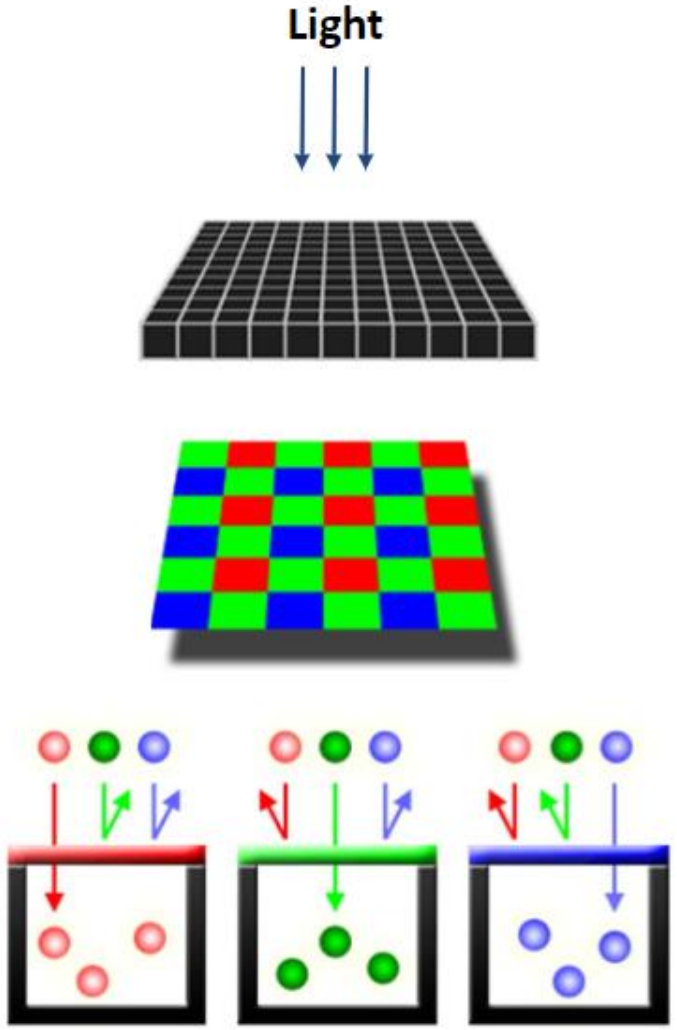
$$l = v\Delta t \,/\, 2$$



# Color Sensing

How camera sensor works

- Imaging element
- Light intensity → Electric signal
- CCD(Charge Coupled Device)
- CMOS(Complementary Metal Oxide Semiconductor)
- Photodiode
- Color filter: R(red), G(green), B(blue)
- Pixel
- Pixel value: 256 levels (0 – 255)




[https://www.cambridgeincolour.com/tutorials/camera-sensors.htm]

# Visual Perception

- OpenNI2 - http://structure.io/openni
- OpenKinect - https://github.com/OpenKinect
- PCL - http://pointclouds.org/
- OpenCV - http://opencv.org/
- ROS opencv_apps - http://wiki.ros.org/opencv_apps
- Bring up
  - [Robot] $ roslaunch rchomeedu_vision **multi_astra.launch**
- Display RGB and Depth images [Robot-Bottom camera]
  - $ rosrun image_view image_view image:=/camera/rgb/image_raw
  - $ rosrun image_view image_view image:=/camera/depth_registered/image_raw

  * [Robot-Top camera] Replace “camera” with “camera_top”

# Take Photo

**Take photo**

- Bring up camera
- $ rosrun rchomeedu_vision **take_photo.py**
- $ rosrun rchomeedu_vision **take_photo_sub.py**
  - $ rostopic pub -1 /take_photo std_msgs/String “take photo”

* Image topic = “/camera_top/rgb/image_raw” (edit code according to the camera used)

* Photo taken is saved in the current folder