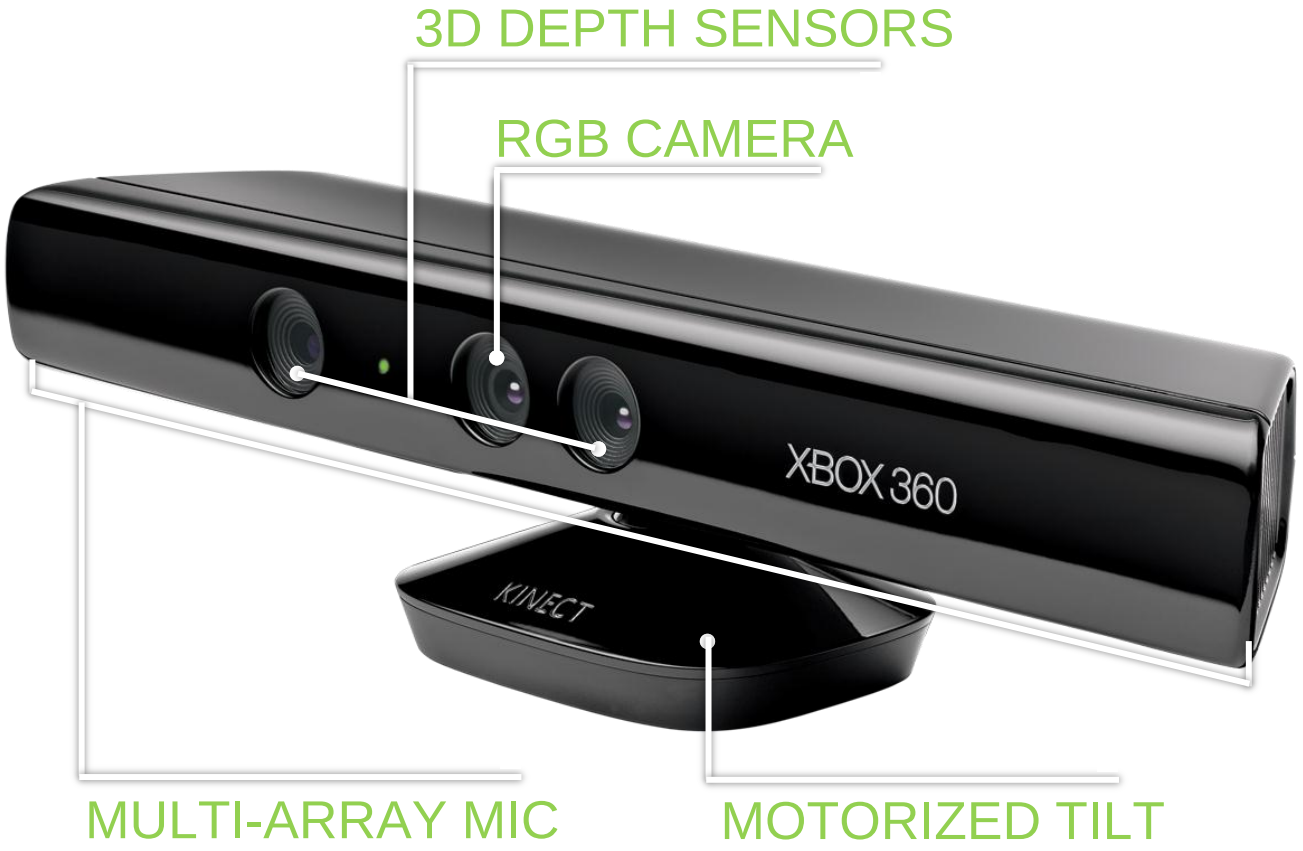
Microsoft® Research
Kinect™ for Windows® SDK beta

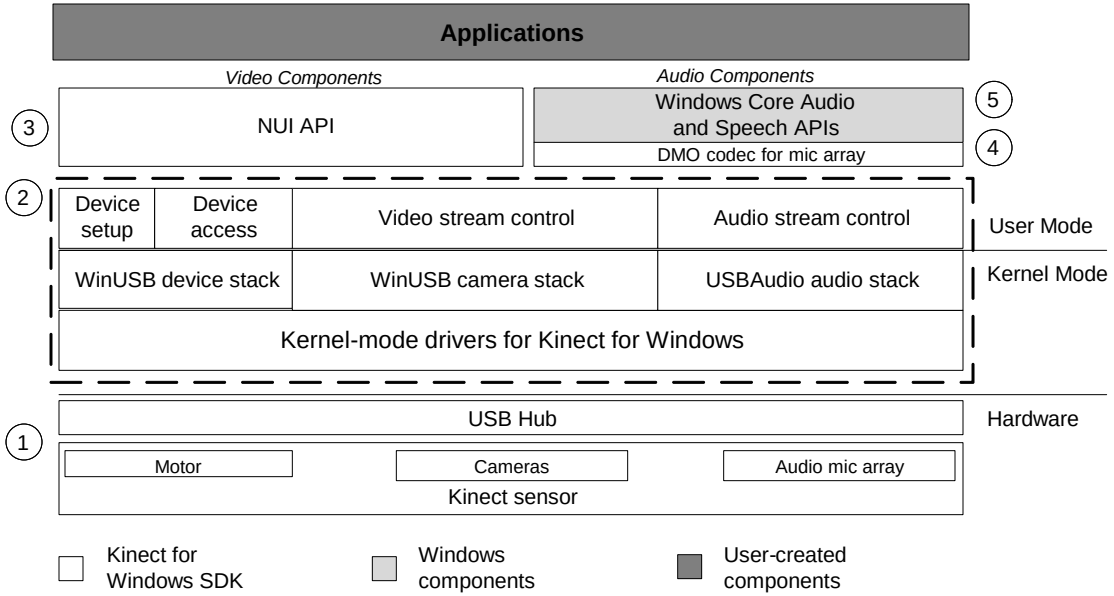
Programming with the Kinect for Windows SDK

What we'll cover

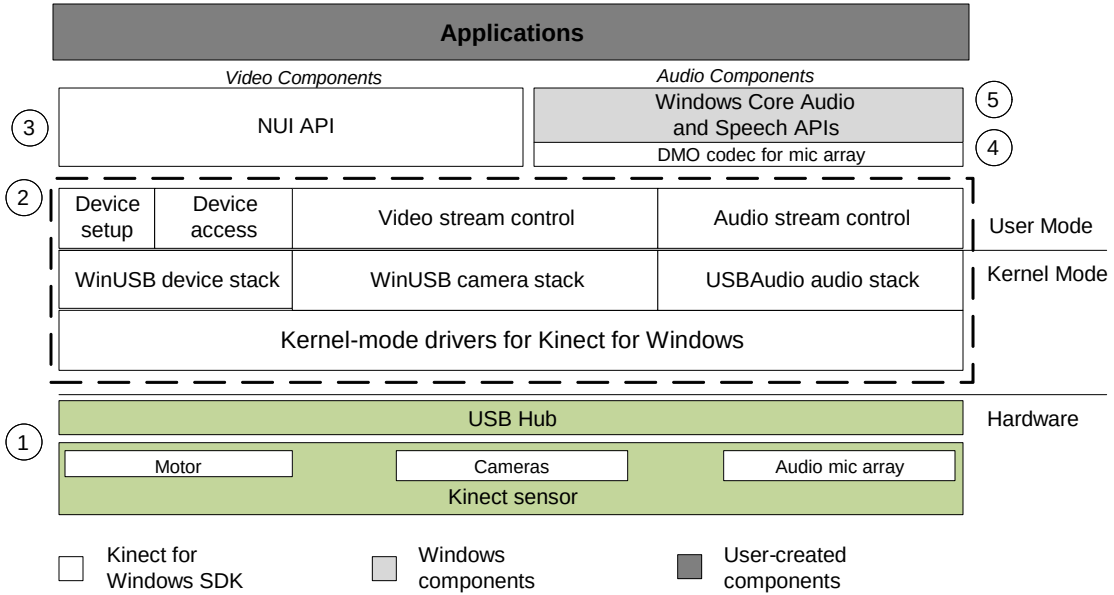
- Kinect Sensor
- Using Cameras
- Understanding Depth Data
- Skeletal Tracking
- Audio


3D DEPTH SENSORS
RGB CAMERA
XBOX 360
KINECT
MULTI-ARRAY MIC
MOTORIZED TILT

SDK Architecture



SDK Architecture



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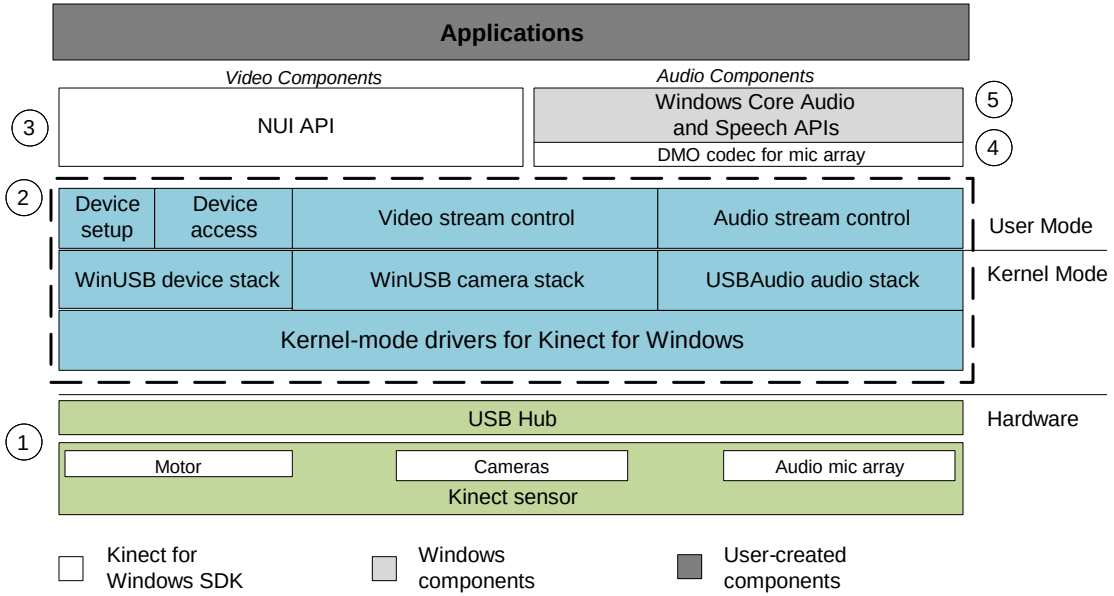

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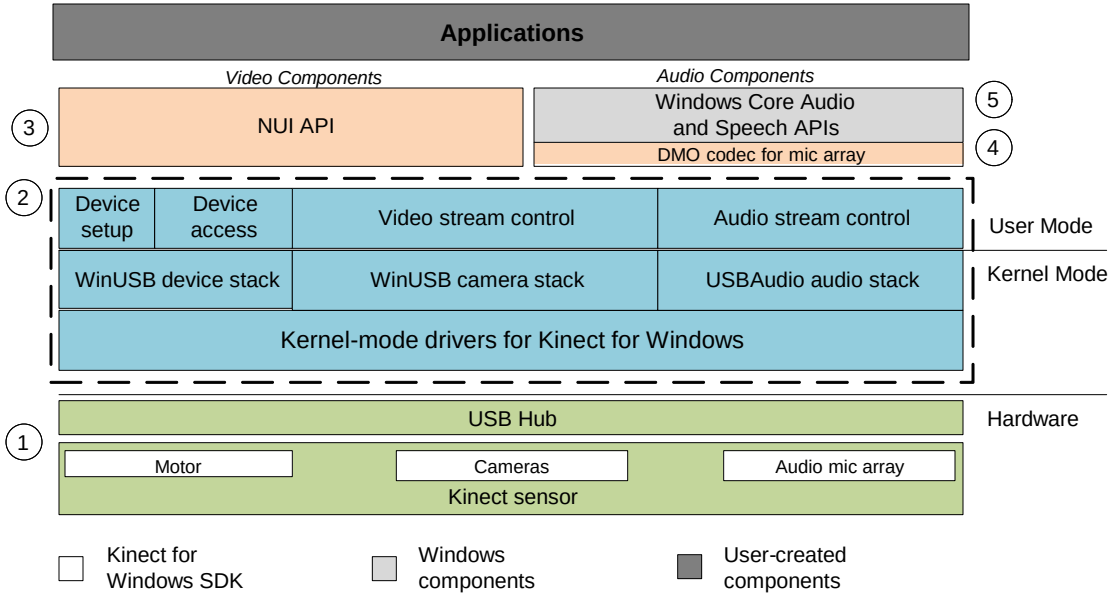

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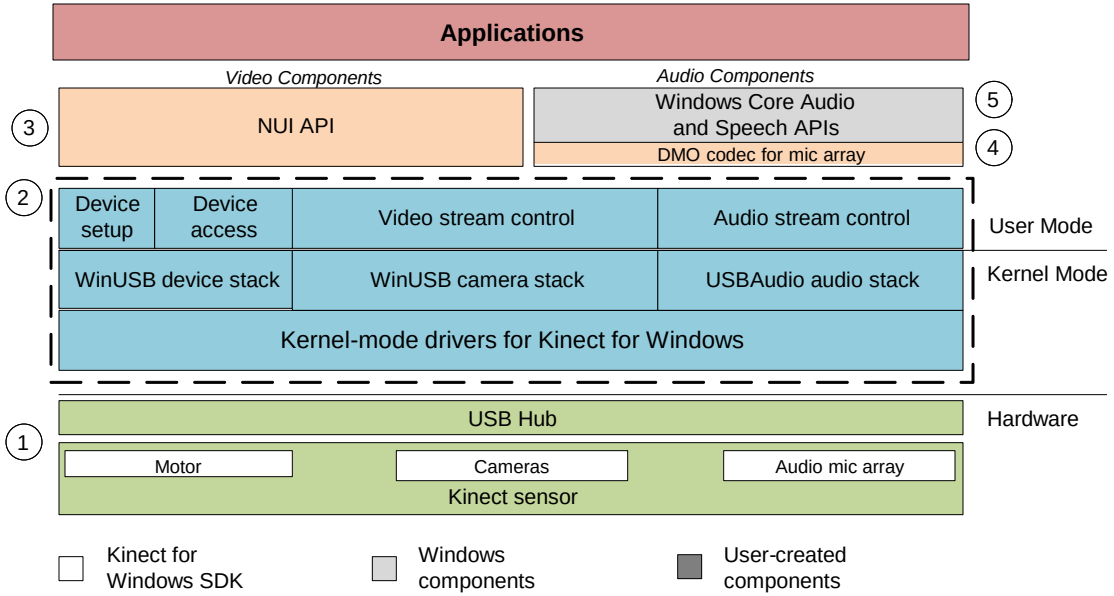


Using Cameras

Demos

Understanding Depth Data

- ImageFrame.Image.Bits
- Array of bytes - `public byte[] Bits;`
- Array
  - Starts at top left of image
  - Moves left to right, then top to bottom
  - Represents distance for pixel in millimeters

Calculating Distance

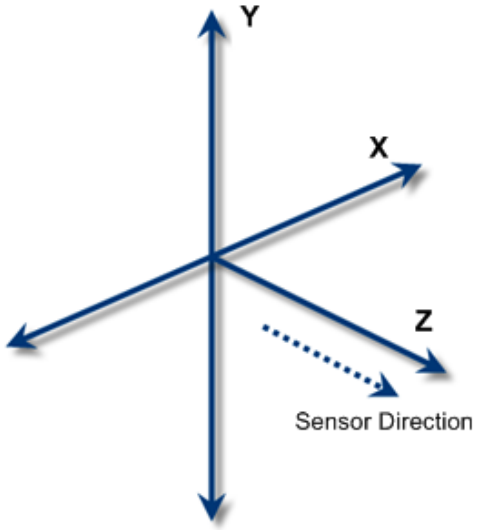
- 2 bytes per pixel (16 bits)
- Depth – Distance per pixel
  - Bitshift **second byte by 8**
  - Distance (0,0) = `(int)(Bits[0] | Bits[1] << 8);`
  - VB `(int)(CInt(Bits(0)) Or CInt(Bits(1)) << 8);`
- DepthAndPlayer Index – Includes Player index
  - Bitshift by **3 first byte** (player index), **5 second byte**
  - Distance (0,0) =`(int)(Bits[0] >> 3 | Bits[1] << 5);`
  - VB:`(int)(CInt(Bits(0)) >> 3 Or CInt(Bits(1)) << 5);`

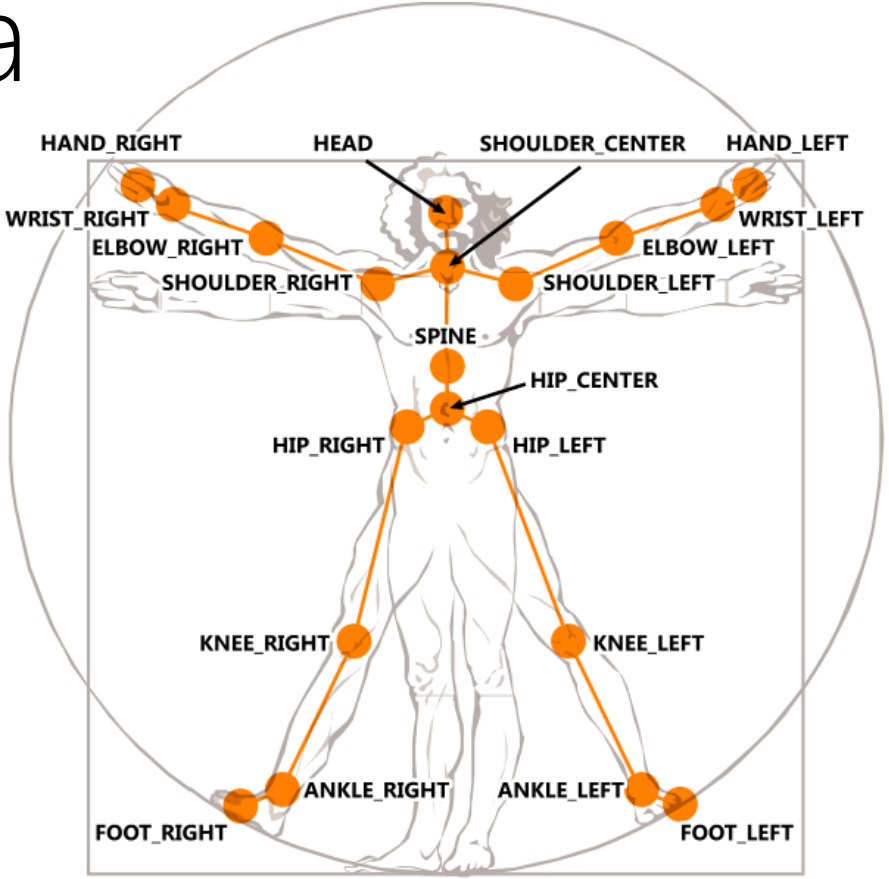
Depth Reference

- Distance Range: 850 mm to 4000 mm range
- Depth value 0 means unknown
  - Shadows, low reflectivity, and high reflectivity among the few reasons
- Player Index
  - 0 – No player
  - 1 – Skeleton 0
  - 2 – Skeleton 1
  - …

Demos

Skeleton Data

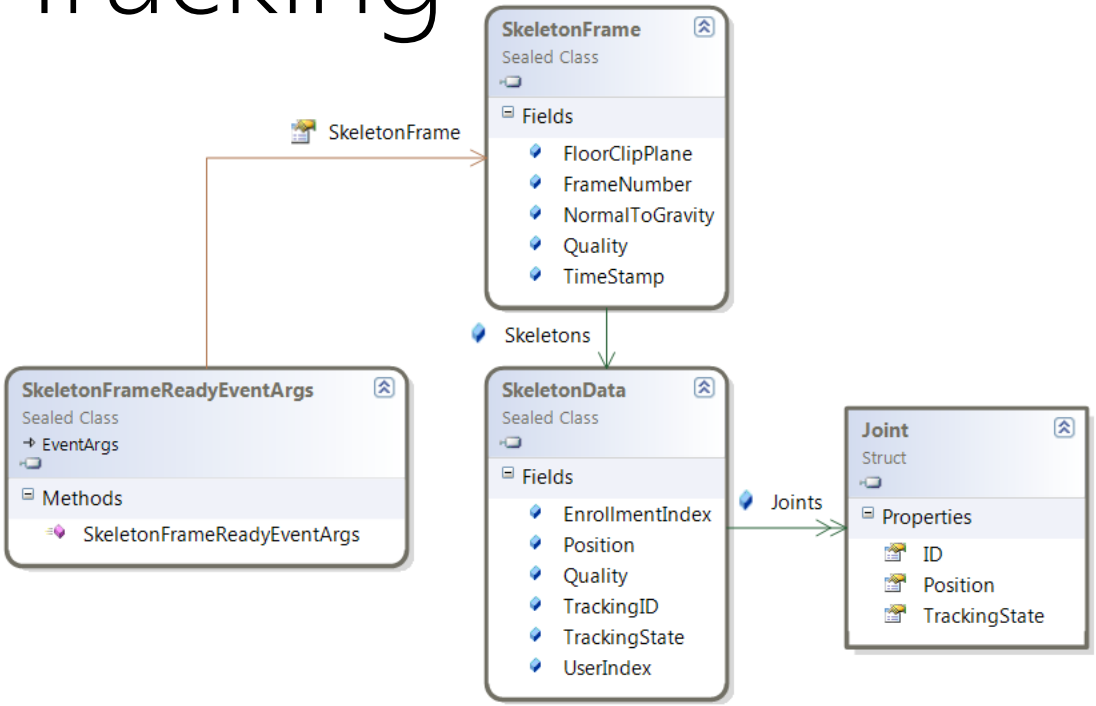




Joints

- Maximum two players tracked at once
  - Six player proposals
- Each player with set of <x, y, z> joints in meters
- Each joint has associated state
  - Tracked, Not tracked, or Inferred
- Inferred - Occluded, clipped, or low confidence joints
- Not Tracked - Rare, but your code must check for this state

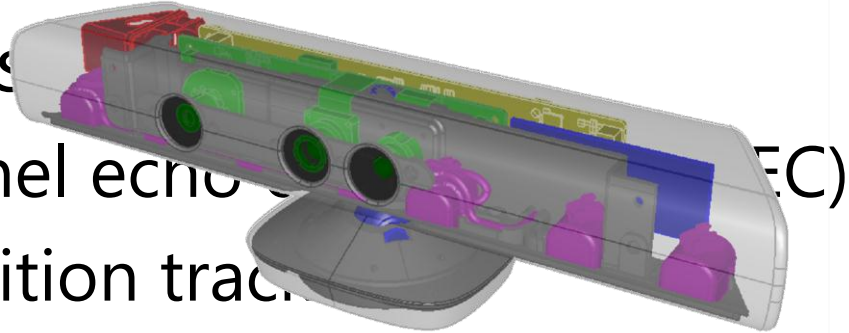
Skeletal Tracking



Demos

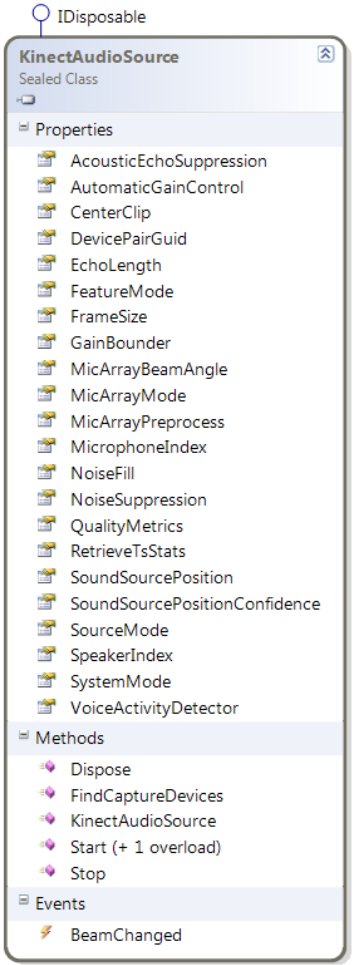
Audio Going Inside of Kinect

- Four microphone array with hardware-based audio proces
  - Multichannel echo [illegible]EC)
  - Sound position trac[illegible]
  - Other digital signal processing (noise suppression and reduction)



Audio

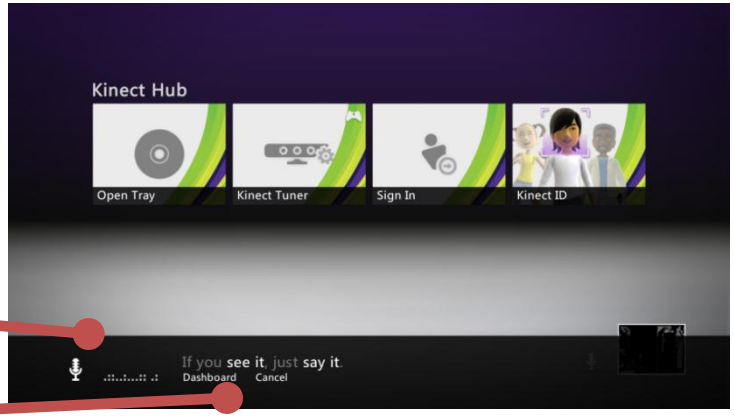
- Kinect as a microphone
- Kinect for Speech Recognition



Multi-modal Feedback

- Engagement model
  - Mic indicator for speech-enabled menus
  - Keyword to engage

- Feedback and confirmation (both passive and active)



Speech Recognition

- Kinect Grammar available to download
- Grammar – What we are listening for
  - Code – GrammarBuilder, Choices
  - Speech Recognition Grammar Specification (SRGS)
    - C:\Program Files (x86)\Microsoft Speech Platform SDK\Samples\Sample Grammars\

Grammar

```
<!-- Confirmation_YesNo._value: string
["Yes", "No"] -->
<rule id="Confirmation_YesNo"
scope="public">
  <example> yes </example>
  <example> no </example>
  <one-of>
    <item>
      <ruleref uri="#Confirmation_Yes" />
    </item>
    <item>
      <ruleref uri="#Confirmation_No" />
    </item>
  </one-of>
  <tag> out = rules.latest() </tag>
</rule>
</rule>
```

```
<!-- Confirmation_Yes._value: string ["Yes"]
-->
<rule id="Confirmation_Yes" scope="public">
  <example> yes </example>
  <example> yes please </example>
  <one-of>
    <item> yes </item>
    <item> yeah </item>
    <item> yep </item>
    <item> ok </item>
  </one-of>
  <item repeat="0-1"> please </item>
  <tag> out._value = "Yes";</tag>
```

Demos

Resources

- Kinect Programming Walkthroughs
  - http://research.microsoft.com/kinectsdk/
- Coding4Fun Kinect Toolkit
  - http://c4fkinect.codeplex.com
- Kinect SDK Quickstarts
  - http://channel9.msdn.com/series/KinectSDKQuickstarts

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