KINECT

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- The Kinect is a full body motion sensing device that lets you use your body as the controller.

- http://www.youtube.com/watch?v=T_QLguHvACs

Kinect

- Kinect seems almost magical the way it can "see" every movement of your body and reproduce it within the video game you're playing. Plus, it recognizes your face and voice so it can pick you out in the room and know who you are, even if you're playing with a group of friends.

What is Kinect?

- Kinect isn't magical at all. It's a highly innovative combination of cameras, microphones and software that turns your body into the video game controller.
- The name Kinect is inspired by the words "**kinetic**," which means to be in motion, and "connect".

Fastest selling consumer electronic device

- After selling a total of 8 million units in its first 60 days, the Kinect holds the [Guinness World Record](#) of being the "fastest selling consumer electronics device".
- 18 million units of the Kinect sensor had been shipped as of January 2012.
- 24 million (as of February 12, 2013)

KINECT Features

- **MOTION SENSOR:**
  Kinect uses a motion sensor that tracks your entire body. So when you play, it's not only about your hands and wrists. It's about all of you. Arms, legs, knees, waist, hips and so on.

- **SKELETAL TRACKING**
  As you play, Kinect creates a digital skeleton of you based on depth data. So when you move left or right or jump around, the sensor will capture it and put you in the game.

- **FACIAL RECOGNITION**
  Kinect ID remembers who you are by collecting physical data that's stored in your profile. So when you want to play again, Kinect will know it's you, making it easy to jump in whenever you want.

- **VOICE RECOGNITION**
  Kinect uses four strategically placed microphones within the sensor to recognize and separate your voice from the other noises in the room, so you can control movies and more with your voice.

Hardware

- There's a trio of hardware innovations working together within the Kinect sensor:
- **Color VGA video camera** - This video camera aids in facial recognition and other detection features by detecting three color components: red, green and blue. Microsoft calls this an "RGB camera" referring to the color components it detects.
- **Depth sensor** - An infrared projector and a monochrome CMOS (complimentary metal-oxide semiconductor) sensor work together to "see" the room in 3-D regardless of the lighting conditions.
- **Multi-array microphone** - This is an array of four microphones that can isolate the voices of the players from the noise in the room. This allows the player to be a few feet away from the microphone and still use voice controls.
- A further look at the technical specifications for Kinect reveal that both the video and depth sensor cameras have a 640 x 480-pixel resolution and run at 30 FPS (frames per second).

Architecture

- The Kinect sensors will send a set of three streams:

- **Image stream** can be displayed like with any other camera (for example to do augmented reality). The Kinect video sensor can return a stream with 2 resolutions: one at **640x480** (at 30 frames per second) and one at **1280x1024** (but at 15 frames per second).

- The depth stream is the determining factor in our case. It will indeed add to each pixel a depth defined by the sensor. So in addition to the 2D position of each pixel (and color) we now have depth. This will greatly simplify the writing of shapes detection algorithms.

- A third stream is sent from the sensor: it is the audio stream from the four microphones.

- Therefore, the key point here concerns the ability of Kinect to give us **three-dimensional** data. Using the NUI library (which comes with the SDK and stand for *Natural User Interfaces*) you will be able to detect the presence of humans in front of the sensor. Kinect can "see" up to 4 peoples and accurately track both of them.

Kinect Brain

- All of a sudden, as a programmer, rather than having access to the pixels of a flat image, or even the depth information from the raw Kinect data, you now have a description of your users as a series of joints in space. For many applications, especially gesture-based interfaces and motion capture, this is exactly the data you need to get started.

Skeletal Tracking

- When Kinect precisely follows a person, it can provide a skeleton made up of key points detected on the user:
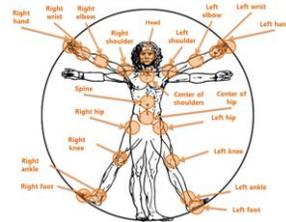

Skeletal Viewer
Demo

Skeletal Tracking

- 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
- Use TransformSmoothParameters to smooth joint data to reduce jitter

Kinect Skeletal Tracking

- To start the teaching process, Kinect developers gathered massive amounts of data from motion-capture in real-life scenarios. Then, they processed that data using a machine-learning algorithm by Jamie Shotton, a researcher at Microsoft Research Cambridge in England. Ultimately, the developers were able to map the data to models representing people of different ages, body types, genders and clothing.
- With select data, developers were able to teach the system to classify the skeletal movements of each model, emphasizing the joints and distances between those joints.
- The trained classifiers assign a probability of a pixel being in each body part and the next stage of the algorithm simply picks out areas of maximum probability for each body part type. So an area will be assigned to the category "leg" if the leg classifier has a probability maximum in the area.
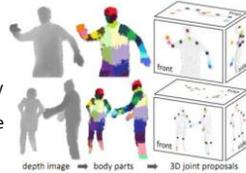
Kinect Skeletal Tracking

- Kinect can also distinguish players and their movements even if they're partially hidden.
- Kinect extrapolates what the rest of your body is doing as long as it can detect some parts of it. This allows players to jump in front of each other during a game or to stand behind pieces of furniture in the room.

- http://www.i-programmer.info/news/105-artificial-intelligence/2176-kinects-ai-breakthrough-explained.html

Depth Information

- Depth data represents the distance and player for every pixel.
- Support for Default and Near m de

Audio data

- Using your Kinect to determine the angle and confidence for where a sound is coming from
- Echo Cancellation & Background separation
- Building a basic speech recognition application to dynamically turn application features on/off
- Speech recognition engine can be used even when the application is not the current active application

Getting started with Kinect

- Installing Kinect
  http://www.codeproject.com/Articles/148251/How-to-Successfully-Install-Kinect-on-Windows-Open

- Kinect for Windows Quickstart Series
  http://channel9.msdn.com/Series/KinectQuickstart

Kinect for Windows SDK

Kinect for Windows v 1

- Kinect for windows SDK v1 was released for Windows 7 on June 16, 2011 in 12 countries.[The SDK includes Windows 7 compatible PC drivers for Kinect device. It provides Kinect capabilities to developers to build applications with C++, C#, or Visual Basic by using Microsoft Visual Studio 2010 and includes following features:
  - Raw sensor streams: Access to low-level streams from the depth sensor, color camera sensor, and four-element microphone array.
  - Skeletal tracking: The capability to track the skeleton image of one or two people moving within the Kinect field of view for gesture-driven applications.
  - Advanced audio capabilities: Audio processing capabilities include sophisticated acoustic noise suppression and echo cancellation, beam formation to identify the current sound source, and integration with the Windows speech recognition API.
  - Sample code and Documentation.

Kinect for Windows 1.5

- In March 2012, Microsoft announced that next version of the Kinect for Windows will be available in May 2012. Kinect for Windows 1.5 will add new features, support for many new languages and would debut in 19 more countries.
- The Kinect for Windows 1.5 SDK woud include
  - 'Kinect Studio' a new app that allows developers to record, playback, and debug clips of users interacting with applications.
  - Support for new "seated" or "10-joint" skeletal system that will let apps track the head, neck, and arms of a Kinect user - whether they're sitting down or standing; which would work in default and near mode.
  - Support for four new languages for speech recognition – French, Spanish, Italian, and Japanese. Additionally it would add support for regional dialects of these languages along with English.

- It would be available in Hong Kong, South Korea, and Taiwan in May and Austria, Belgium, Brazil, Denmark, Finland, India, the Netherlands, Norway, Portugal, Russia, Saudi Arabia, Singapore, South Africa, Sweden, Switzerland and the United Arab Emirates in June.

Programming with Kinect

- Once you have Kinect SDK installed, add its reference to your application and start having fun.

Sample Code

```
void kinectRuntime_SkeletonFrameReady(object sender, SkeletonFrameReadyEventArgs e)
{
    SkeletonFrame skeletonFrame = e.SkeletonFrame;

    foreach (SkeletonData data in skeletonFrame.Skeletons)
    {
        if (data.TrackingState == SkeletonTrackingState.Tracked)
        {
            foreach (Joint joint in data.Joints)
            {
                switch (joint.ID)
                {
                    case JointID.HandLeft:
                        if (joint.Position.W > 0.6f) // Quality check
                            leftHandGestureRecognizer.Add(joint.Position.ToVector3());
                        break;
                    case JointID.HandRight:
                        if (joint.Position.W > 0.6f) // Quality check
                            rightHandGestureRecognizer.Add(joint.Position.ToVector3());
                        break;
                }
            }
            return;
        }
    }
}
```

Kinect Applications

- TeleHuman & BodiPod
- http://www.canadianmanufacturing.com/design-engineering/news/queen%E2%80%99s-researchers-create-life-sized-3d-hologram-for-videoconferencing-62944

Kinect Applications

- Employees at the Microsoft India Development Centre (MSIDC) in Hyderabad have developed applications using Kinect, which would help hearing and speech impaired 'talk' to others across the world, and visually impaired 'walk' their way to their destination safely through objects in an indoor space.

- **KinectBridge : talk to others across the world:** Kinect Bridge, the application that we have developed using Kinect, recognises dactylology (a representation of the letters of a writing system or a numeral system using only the hands) and converts it into text in a chat window, thereby establishing a seamless communication between a speech impaired and a normal person, says Bangaru Venkatesh, team leader of Kinect Bridge project.

  "We are taking the first baby step with Kinect Bridge, which is currently under development. This could also be used to translate gestures into voice. Commercialising …? Microsoft will take it further from here. They (Microsoft) can put it up for 'moonlighting' and will have no liability on these applications," he adds.

- **Kinectacles: for visually impaired people :** Another innovation developed using Kinect is Kinectacles. As the name suggests, it helps visually impaired 'Kinect' spectacles. According to team leader Rishabh Verma, Kinectacles technology features near-real time and accurate depth recognition, and helps a visually impaired person navigate indoors on his own.

- Kinect Bridge and Kinectacles were part of the 58 ideas showcased at Microsoft's Garage Science Fair at MSIDC on Thursday. Conceptualised by Microsoft's headquarters in Redmond, USA, four years ago, "the Garage Science Fair is aimed at encouraging grassroot innovations among employees in their spare time," says Matt Hempey, senior principal solution manager, Microsoft IT, Hyderabad.

More news on Kinect

- Microsoft will be adding new functionality to the Xbox 360 that tracks users' physical activity across multiple Kinect games. The report also says that there will be a sensor accessory—codenamed Joule—that will track your heart rate while playing. Stats on your activity, measured against various fitness goals, will live in the cloud.
- **Kinect Play Fit:** No time frame for the rollout of Kinect Play Fit is given, but it's expected to come via a dashboard update like the one that introduced the Xbox 360's new content-streaming initiative. Microsoft has been promoting Kinect games like *Just Dance*, *EA Sports Active* and *Your Shape* as convenient alternatives to going to the gym and this rumor feels in line with that mode of thinking.
- Microsoft reportedly working on Kinect-enabled laptops