Ju-Jutsu Training Kinect Application

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Outline

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Ju-Jutsu

- `Ju Jutsu` is a Japanese martial art.
- Like most martail arts, it includes Thai Pad training.

Increase of Ubiquitous Technology

Motion Sensors...

- Different sensors include:
  - PlayStation EyeToy.
  - Microsoft Kinect.
- Applications supporting activities:
  - Nike+ Kinect Training.
  - Ubisoft's Just Dance.
- However, there are no contact sports fitness related applications.

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Project Impact

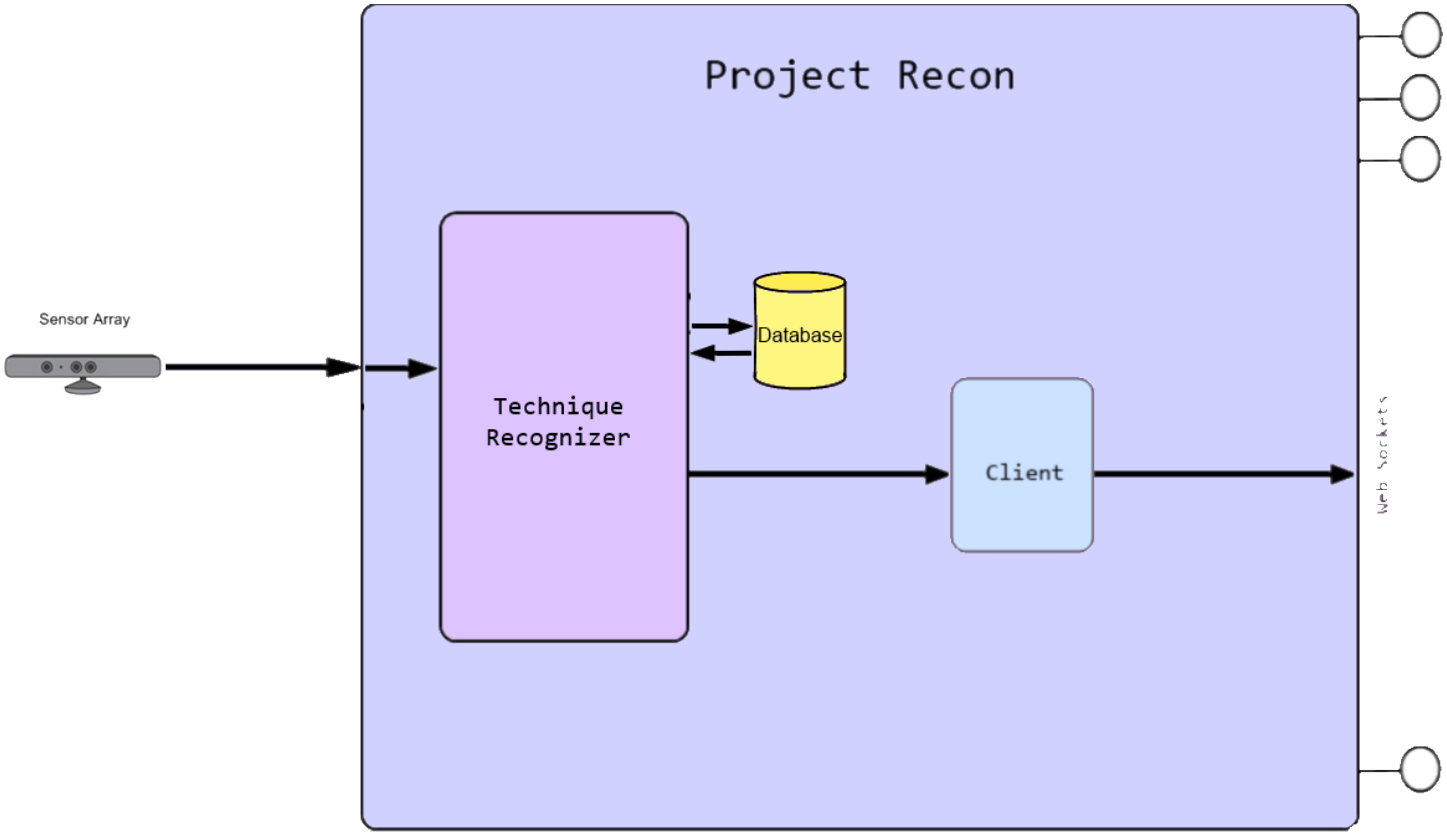
- Embedded systems project
- Multiple inputs from a practitioner during a workout session through different input sources
- Main monitor will be used as the interface and to display sessions

Input Sources and Different Components

- Seismic sensor equipped Thai Pads
- Kinect sensor (Project Recon)
- Optional input
  - Pulse rates
  - Lactic acid levels
  - Respiration rates
  - and any similar measurement . . .

Outline

Project Recon Architecture



Kinect

- Four components
  - Infrared emitter
  - Infrared sensor
  - Color camera
  - Microphone
- Four different streams
  - Depth stream
  - Color stream
  - Skeleton stream
  - Audio stream

Outline

XNA

- Framework based on .NET Compact framework
- Created by Microsoft to support game development
- Basic platform for the indie games on XBOX Live
- Language used is C♯

Kinect SDK

KINECT™
for Windows®

- Is the official SDK for the Kinect system
- Manages data streams

Socket Programming

- Enables Processes to communicate
- Used to connect between Project Recon and the Interface
- Uses client-server model

Outline

Project Requirements

- Real time recognition
- Robust and Dynamic
- Plug in to interface

Outline

The Challenges in Kinect

- The user always faces the Kinect
- Kinect does not differentiate between facing and not facing
- Solution:
  - Normalize the skeleton of the user (Always ends up facing)

Normal Vector

- Create normal between vectors $\vec{r}$, $\vec{c}$, and $\vec{l}$

$$\vec{N} = (\vec{r} - \vec{c}) \times (\vec{l} - \vec{c})$$

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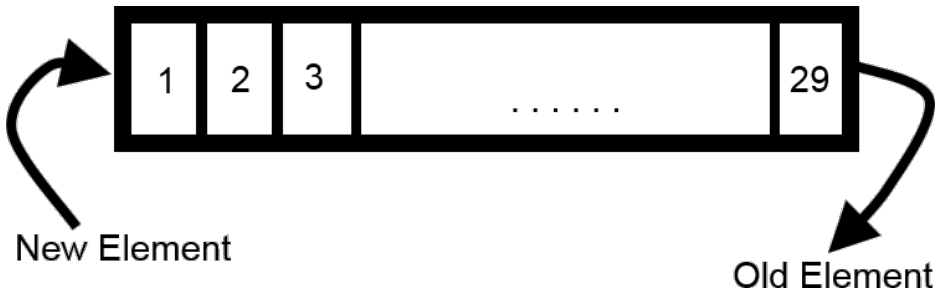
Glyphs Method

- Rotates the skeleton of the user
- Draws the path joints take and stores it in an image
- Each joint will have its own exclusive color

Outline

Joint Positions Lists

- Creates a list (n=30)
- The list stores object types StoreGesture (Position, Time Stamp)



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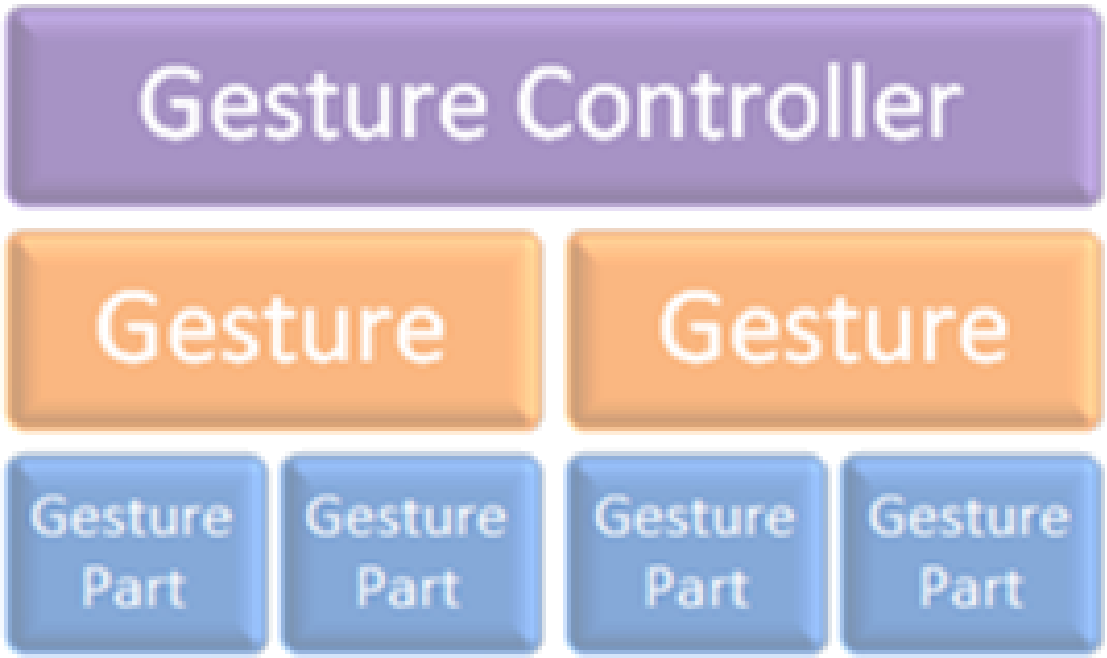
MCS UK

- Microsoft Consultant Services UK
- Gesture service for Kinect for Windows
- The gesture service is written in C♯
- Similar to the JPL in a manner.

Architecture



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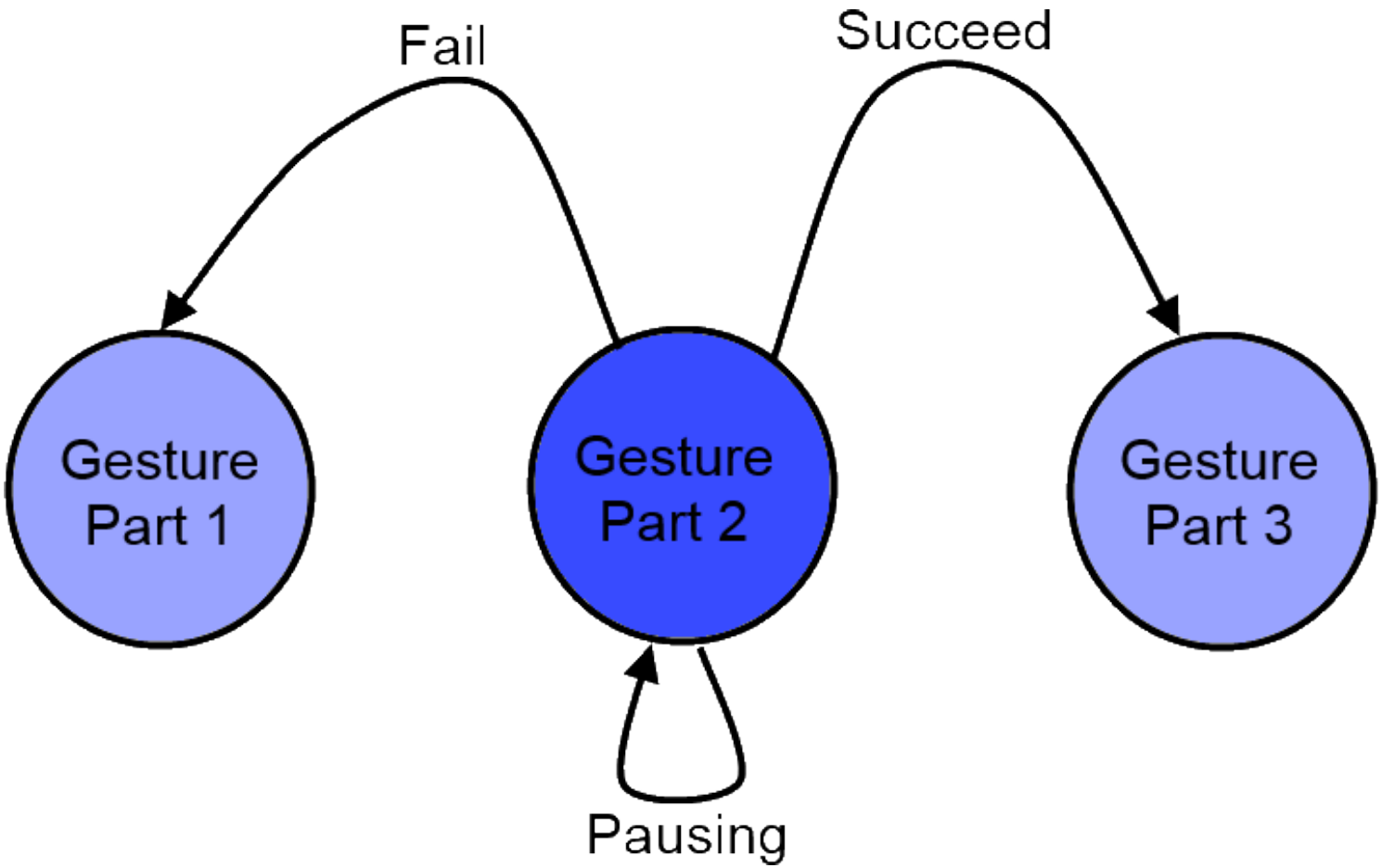

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Communication to the Interface

- Connection is attempted once Kinect is plugged and ready
- The interface listens for gestures
- User sends gestures with their timestamps
- Once connection to the interface falls, program terminates

Outline

Demonstration

Please Hold for a `Demonstration`!
[this will only take few minutes]
. . . I lied

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Summary

- Real time recognition was accomplished by Kinect's fast streaming.
- The Robust and Dynamic requirement was not fully possible was Kinect has a lot of limitations.
- Plugging in to the interface, was possible through Socket programming.

- Outlook
  - Differentiation between facing and not facing(Solved in the new Kinect).
  - Detecting minor movements.

Q&A

Thank you for listening,
floor is open for Q & A