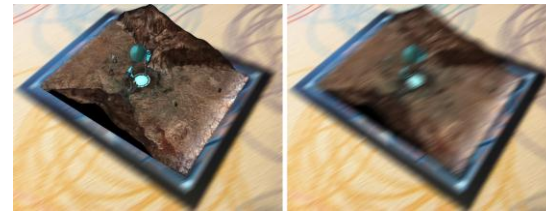


FIContent - Reality Mixer

- Seamless Mixed Reality
 - Real-time low latency/high BW
 - Context aware rendering
 - Plus physical and auditory
- Overview
 - Fast Feature Tracking
 - Context Aware Lighting
 - Camera Artifact Matching



Fast Feature Tracking

- Pervasive Game Platform - Question:
 - How do we enable augmented reality games on the web?
- Idea:
 - Simple tracking of objects with a certain color, e.g.:
 - Street Lamp
 - Flashlight
 - Road Sign
 - Tennis Ball
 - Robot Moons...

Skye Wars

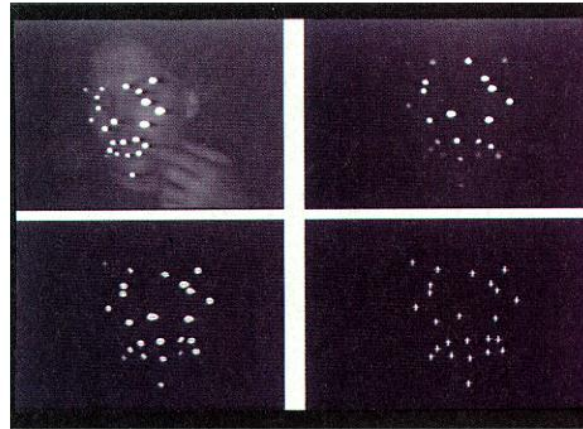


- Unity3D iOS Game for SIGGRAPH 2013
 - on iTunes App Store (bit.ly/SkyeAR)
 - Project Skye: luminous steerable floating robot
 - GPU Fast Feature Tracking parallel stream reduction method
 - Open Source MIT (bit.ly/githubARFFT)

Fast Feature Tracking

- Web3D Solution Rationale:
 - We selected to use XML3D with NaCl
 - Process camera stream image from XML3D in NaCl code via XFlow
 - Return 2D tracked position in object matrix to XML3D rendering
 - Not so easy currently to do our GPU reduction, so optimize on CPU
 - Algorithm to minimize cpu/memory bottleneck

Fast Feature Tracking



Lance Williams [1990]

Figures 14-17. Tracking spots on performer's face.

- Algorithm

- 1st moment of the integral of the segmented image

- for each pixel x in width

- if (feature_detected())

- sum += x

- hit++

- average hit x = sum / (hit * width)

Fast Feature Tracking

- Compute for both x & y
- Key optimizations
 - Minimize inner loop detection comparisons to ~30fps

```
for each pixel y in height
  for each pixel x in width
    if (feature_detected())
      sum += x; hit++
      sumY[x] += y; hitY[x]++
average hit x += sum / (hit * width)
avgY = ( sum of each sumY / (hitY & height) ) / hitX
```
 - Simplify feature_detected() to ~60fps

```
color.g > threshold
```

Fast Feature Tracking

[Demo]