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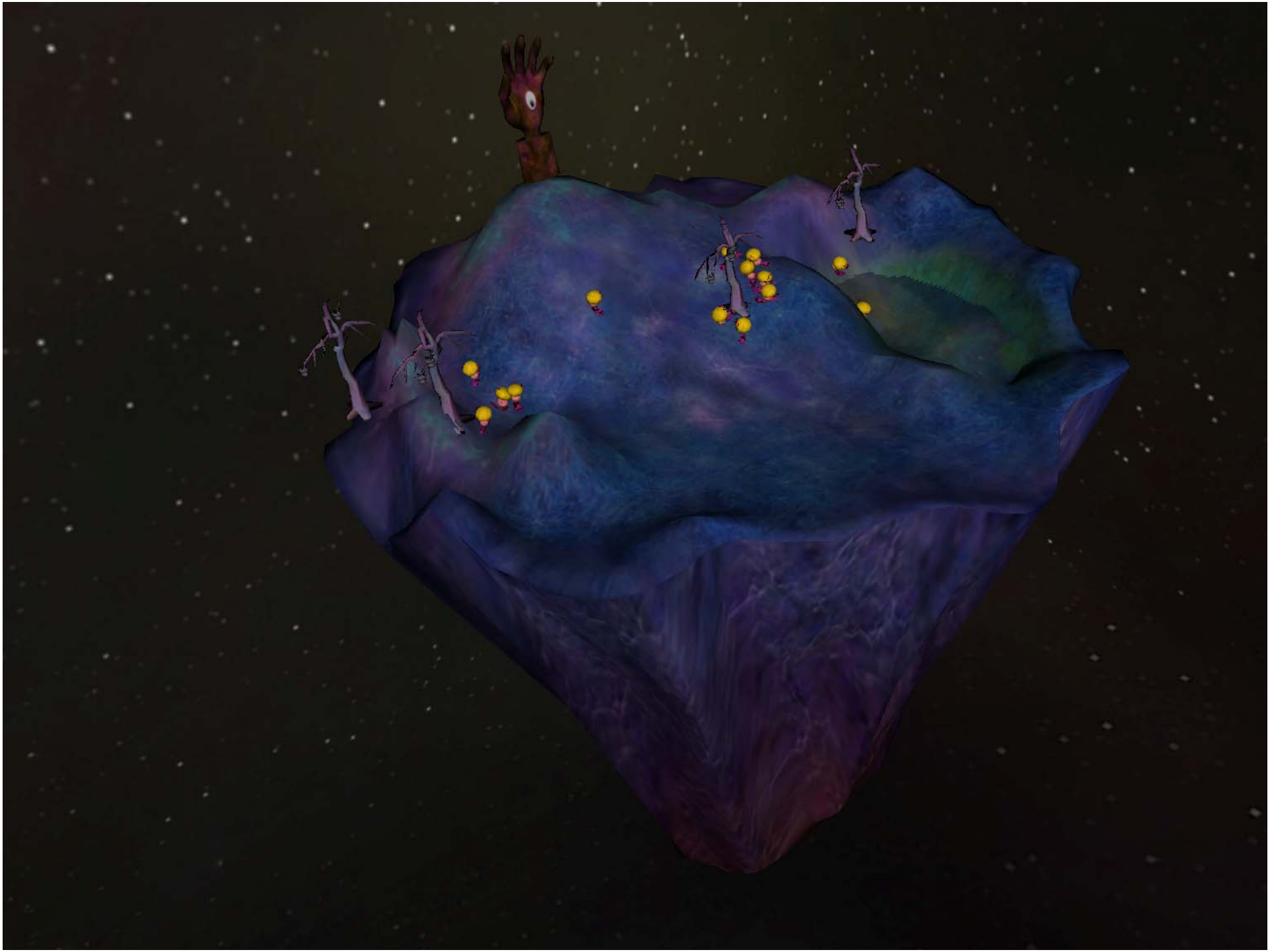


PLANET DOGGUM

Introduction

- Goals
  - Create a multi-user god game which uses a novel combination of finger and hand-stroke gestures
  - Create a testbed kiosk where multiple users can interact with the system without need of training or formal introduction

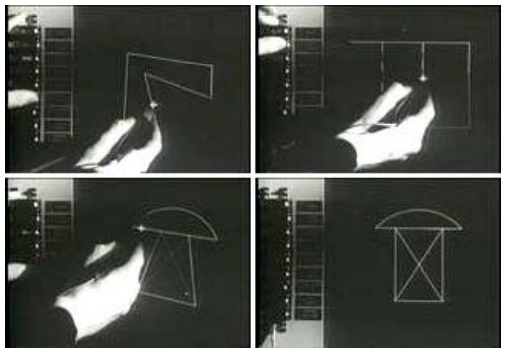
PLANET DOGGUM

Introduction

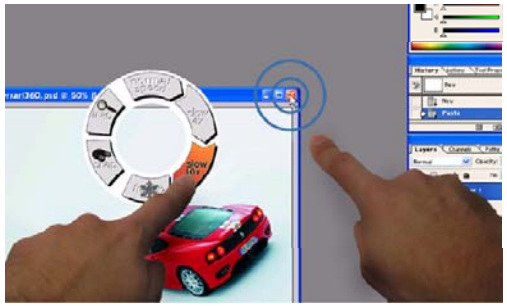
- Assumptions
  - Gross body gestures are being adequately explored by modern consoles as an alternative to a traditional controller
  - Physical proximity of users can enhance gameplay experience
  - Most interactions with games involves physical disconnect between user and image
  - Casual games have largest growth potential
  - Gesture computing (base) technology has reached sufficient maturity for rapid prototyping.

PLANET DOGGUM

Introduction

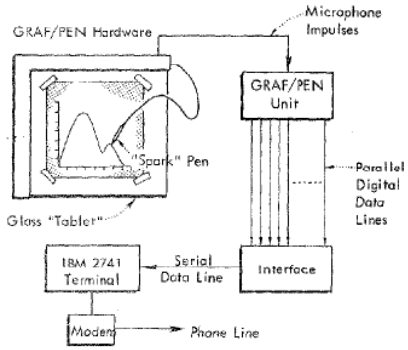


Sketchpad



Slider

- Related Work (Gesture-Based Computing)
  - Sutherland's Sketchpad (1963)
  - Jones and Katyl's GRAPHPAK (1974)
  - Minsky's gesture recognition system (1984)
  - Hong and Landay's SATIN (2000)
  - Benko, Wilson, Baudisch's Stretch, X-Menu, and Slider techniques (2006)
  - Microsoft's Tablet SDK (2007)



GRAPHPAK

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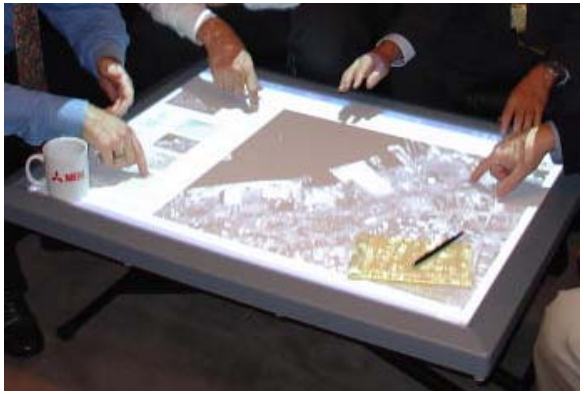
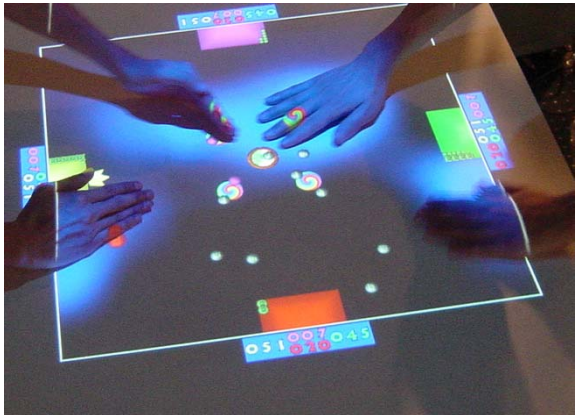
Introduction

- Related Work (Multi-point Touch Systems)
  - Krueger's VIDEOPLACE (1991)
  - Wellner's Digital Desk (1993)
  - Dietz and Leigh's DiamondTouch (2001)
  - Rekimoto's SmartSkin (2002)
  - Han's Low-Cost FTIR (2005)
  - Morris et. al.'s Cooperative Gestures (2006)

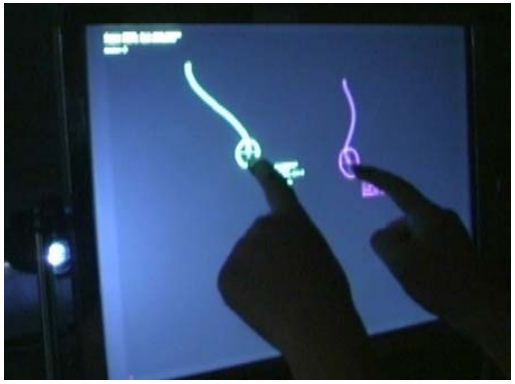


DiamondTouch



SmartSkin

FTIR



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Introduction

WarioWare

Lost Magic

- Related Work (Gesture-based Gaming)
  - Lost Magic (Ubisoft/Taito Corp.)
    - Draw symbols to cast spells
  - WarioWare: Smooth Moves (Nintendo)
    - "The Umbrella": player holds Wiimote like an umbrella handle
    - "The Elephant": player holds Wiimote against nose, like an elephant's trunk
    - "Darts": player simulates action of throwing a dart with the Wiimote

PLANET DOGGUM

Hardware

- Multi-touch Display
  - Leverages:
    - open source software libraries (OpenCV)
    - standards-based 3D protocols (X3D)
    - Simple, low-cost hardware
    - FTIR technology
      - Based on Han’s research (2005)

PLANET DOGGUM

Hardware

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PLANET DOGGUM

Hardware

- Multi-touch Display
  - 22” x 35”
  - LEDs: 850 nm
    - parallel series of banks of five
    - 1.03 A/9.5V
  - PixeLINK 1394 camera
    - 1024 X 768 monochrome uncompressed
  - NEC WT610E Projector
    - 2000 lumens
    - 1024 x 768 native resolution
  - Server
    - Intel Core 2 Duo 2.66 GHz
    - 4 GB RAM
    - PCI Express
    - Nvidia 8800 GTX

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Hardware

- Multi-touch Display

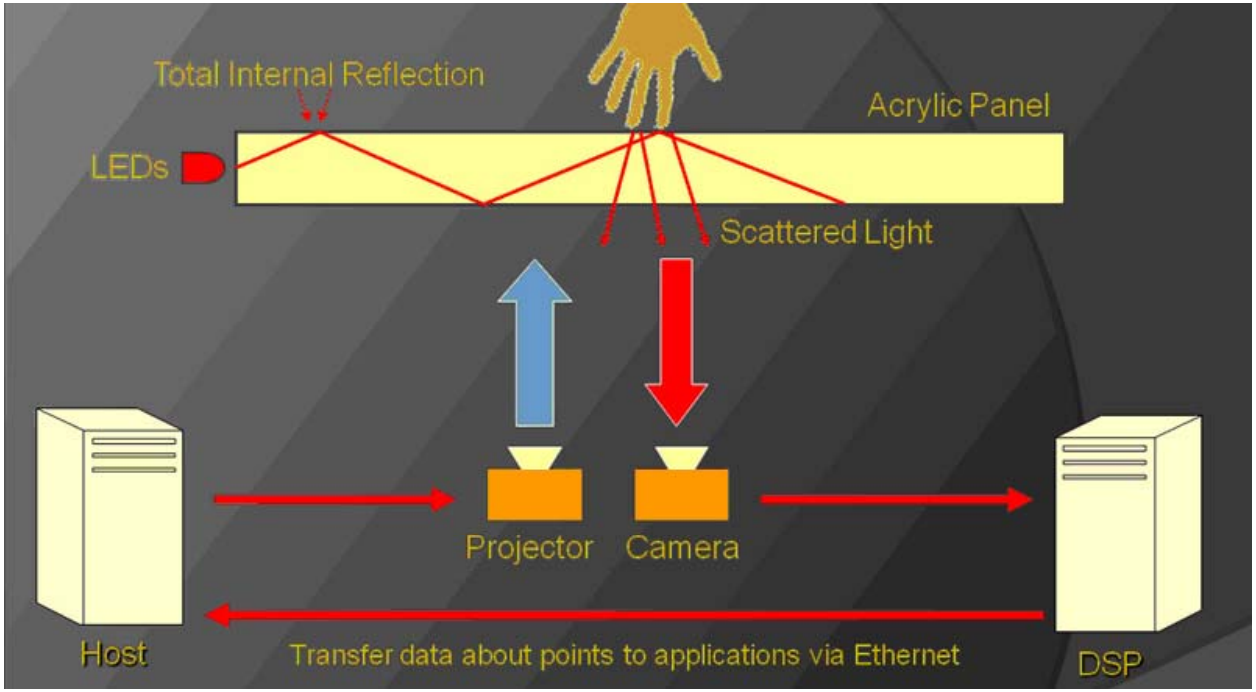
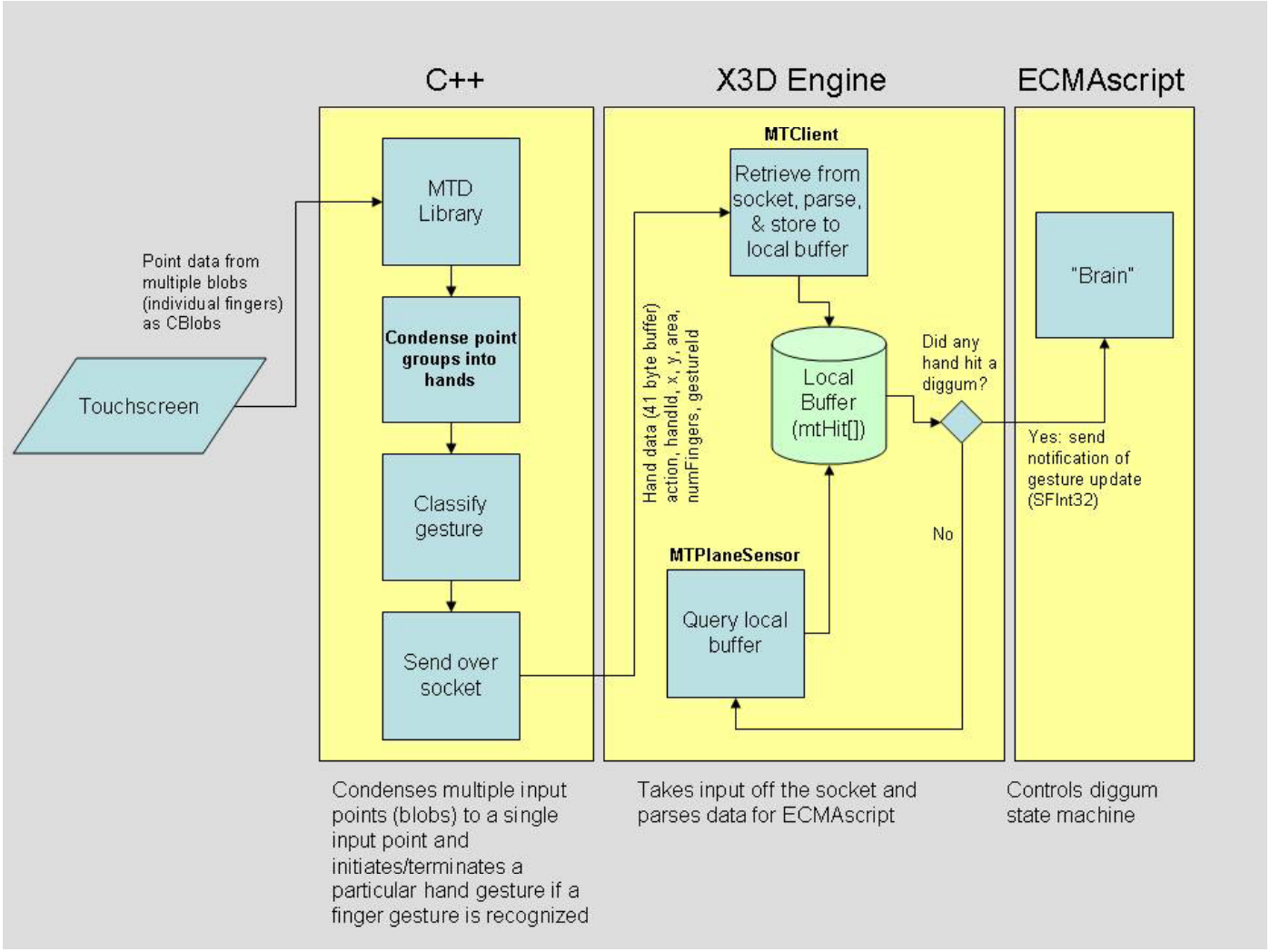


Diagram courtesy Drexel infinitouch

PLANET DIGGUM

System Architecture



PLANET DOGGUM

System Architecture

Server (C++)

- Implementation of MTD library developed by Drexel's infinitouch team
  - Based on OpenCV
    - Bradski, 2002
- Retrieves **blob** information from table using cvblobslib
  - Based on Dave Grossman's algorithm
  - Extract blob components from binary/grayscale image
  - Filter to get objects of interest

PLANET DOGGUM

System Architecture

```
CBlobResult blobs;

blobs = CBlobResult( inputImage, NULL, 100, true );

blobs.Filter( blobs, B_INCLUDE, CBlobGetArea(),
        B_GREATER, 5000 );

CBlob blobWithBiggestPerimeter, CBlob blobWithLessArea;

blobs.GetNthBlob( CBlobGetPerimeter(), 0,
        blobWithBiggestPerimeter );

blobs.GetNthBlob( CBlobGetArea(), blobs.GetNumBlobs() -
        1, blobWithLessArea );

IplImage *outputImage;

outputImage = cvCreateImage( cvSize( inputImage->width,
        inputImage->height ), IPL_DEPTH_8U, 3 );

cvMerge( inputImage, inputImage, inputImage, NULL,
        outputImage );

blobWithBiggestPerimeter.FillBlob( outputImage, CV_RGB(
        255, 0, 0 ));

blobWithLessArea.FillBlob( outputImage, CV_RGB( 0, 255, 0
        ));
```

Source: http://opencvlibrary.sourceforge.net/

PLANET DOGGUM

System Architecture

Server (C++)

```
Initialize tracker

Initialize output handler

Capture single frame

while (blobs) {

     Determine blob state (add, update, delete)

     On add: add to hand or create new hand and
        determine gesture

     On update: update position/gesture

     On delete: remove from current point list

}

Send hand data (action, id, centerX, centerY, area,
numFingers, gesture) over socket
```

PLANET DOGGUM

System Architecture

X3D Engine

- Custom Nodes added via DLLs (C++)
  - Interface between server and X3D world file
  - Custom MTClient node
  - Modified PlaneSensor/TouchSensor

PLANET DIGGUM

System Architecture

X3D Engine

```
Retrieve hand data from socket
Write hand data to local buffer
Upon request, retrieve hand data from local buffer
if (diggumHit)
     Send gesture from local buffer to ECMAscript
```

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PLANET DIGGUM

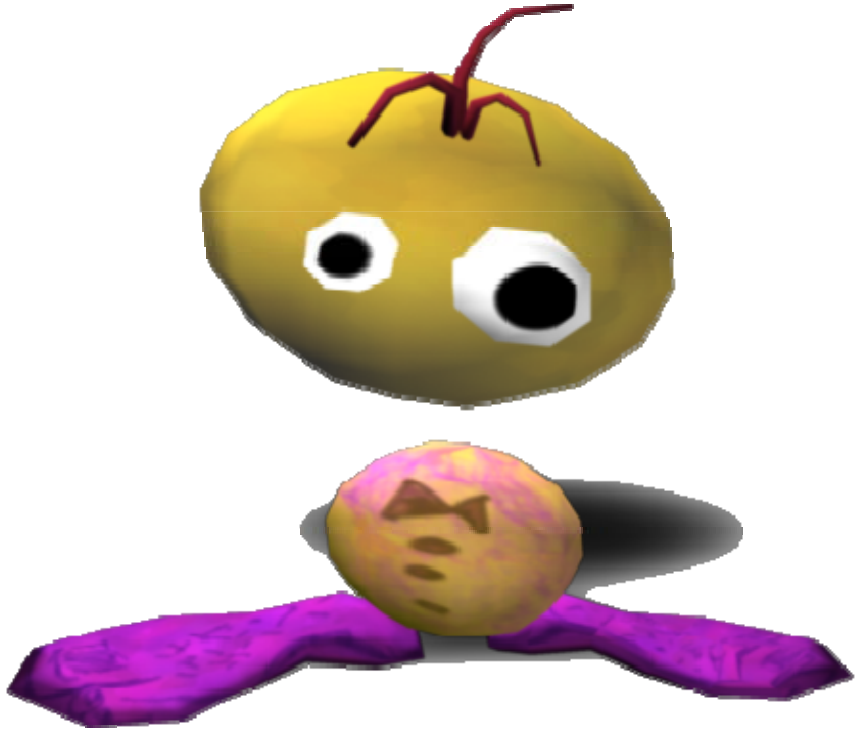
System Architecture

ECMAscript

- Controls “brain” logic of diggums
- If the diggum is hit, retrieve current gesture from custom nodes and change diggum state accordingly

PLANET DIGGUM

The Diggum



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The Diggum

- How diggums think (“the brain”)
  - Each has a “temperament”
    - Six different variables (bored, scared, religious, happy, hungry, tired) on a (-1,1) scale
    - Different combinations of these “temperament” variables, as well as possible user input, location (water, etc.), and a little randomization result in 15 different states

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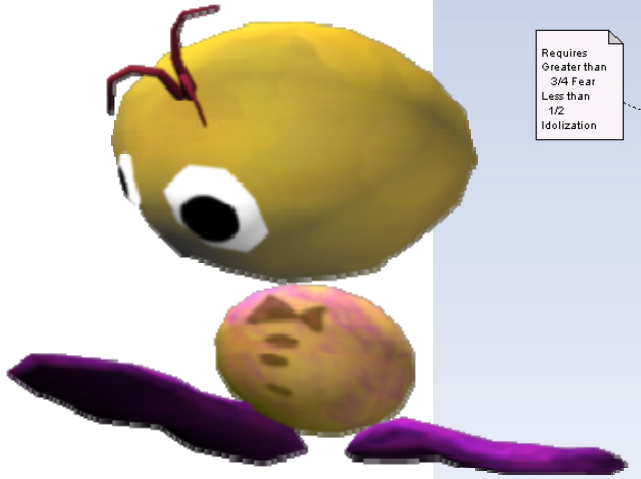
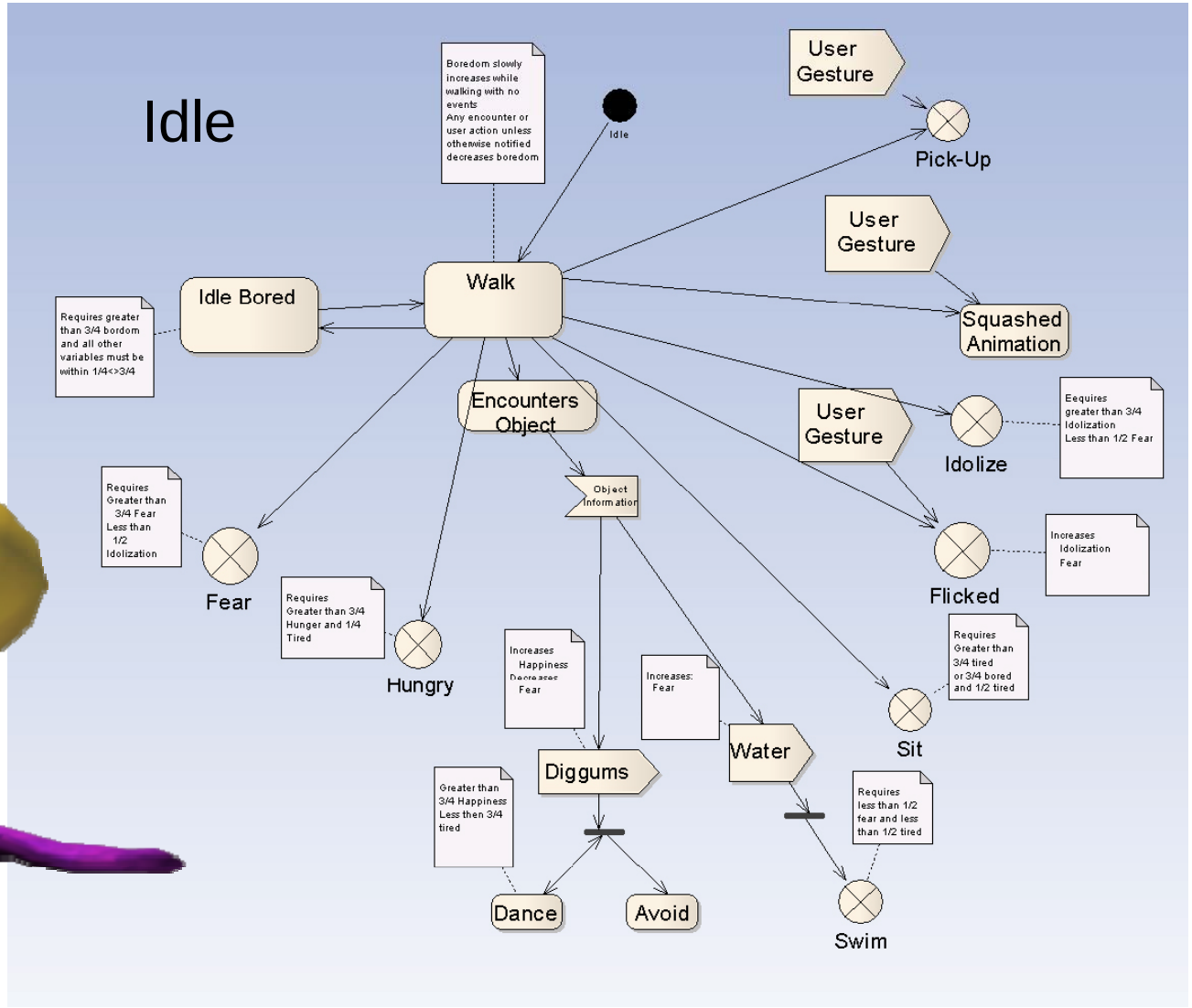
The Diggum





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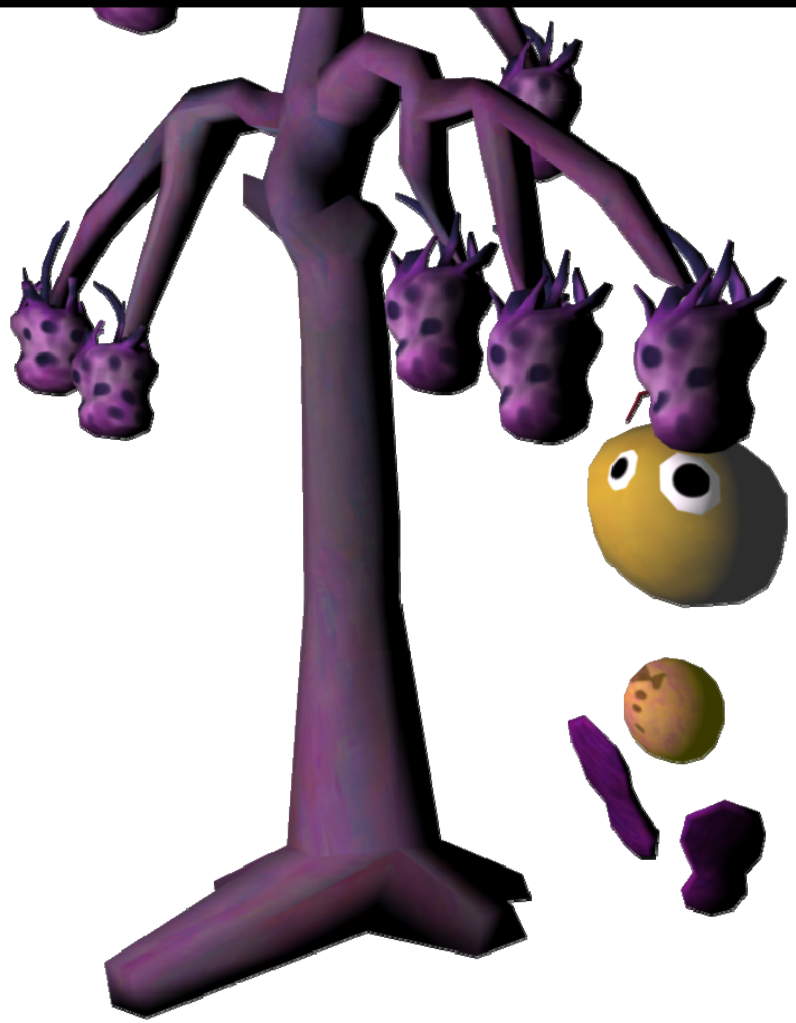
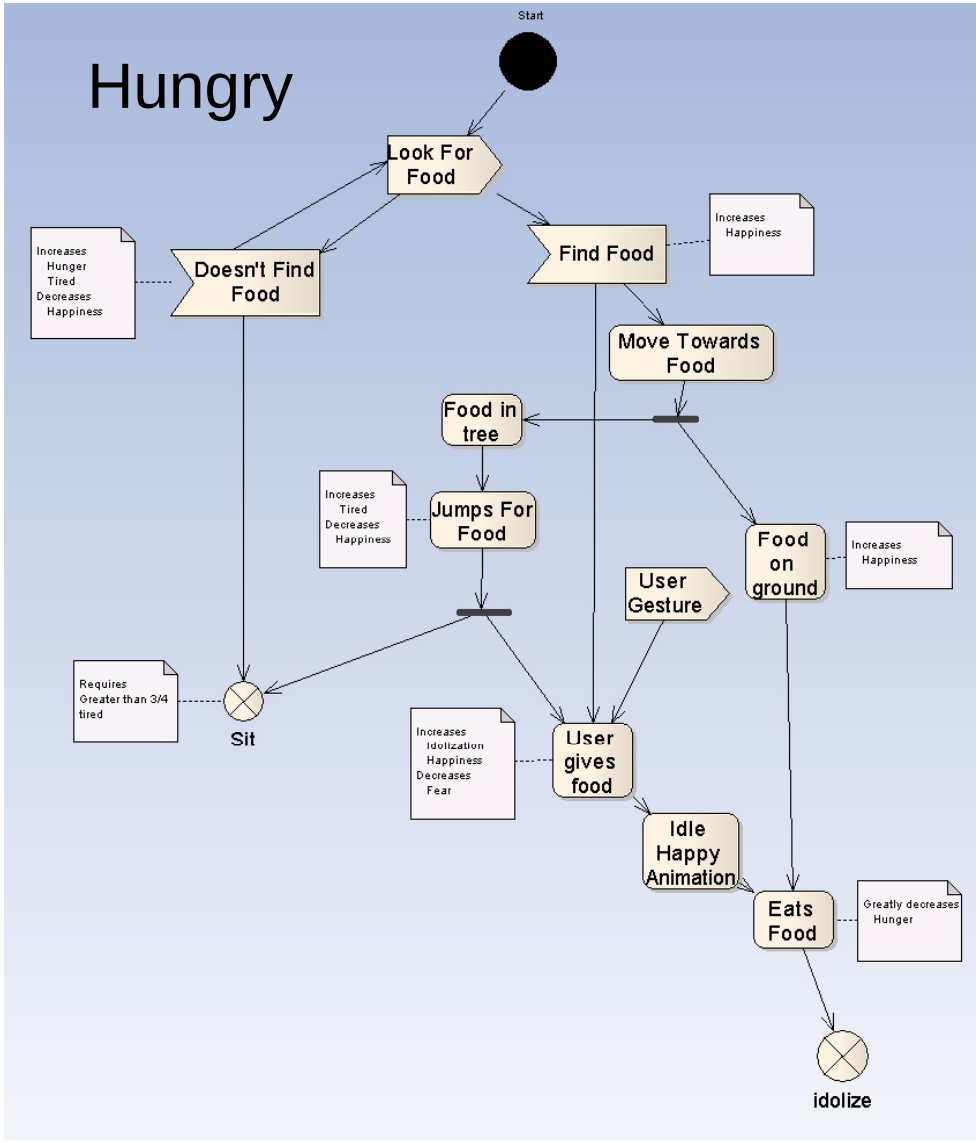
The Diggum





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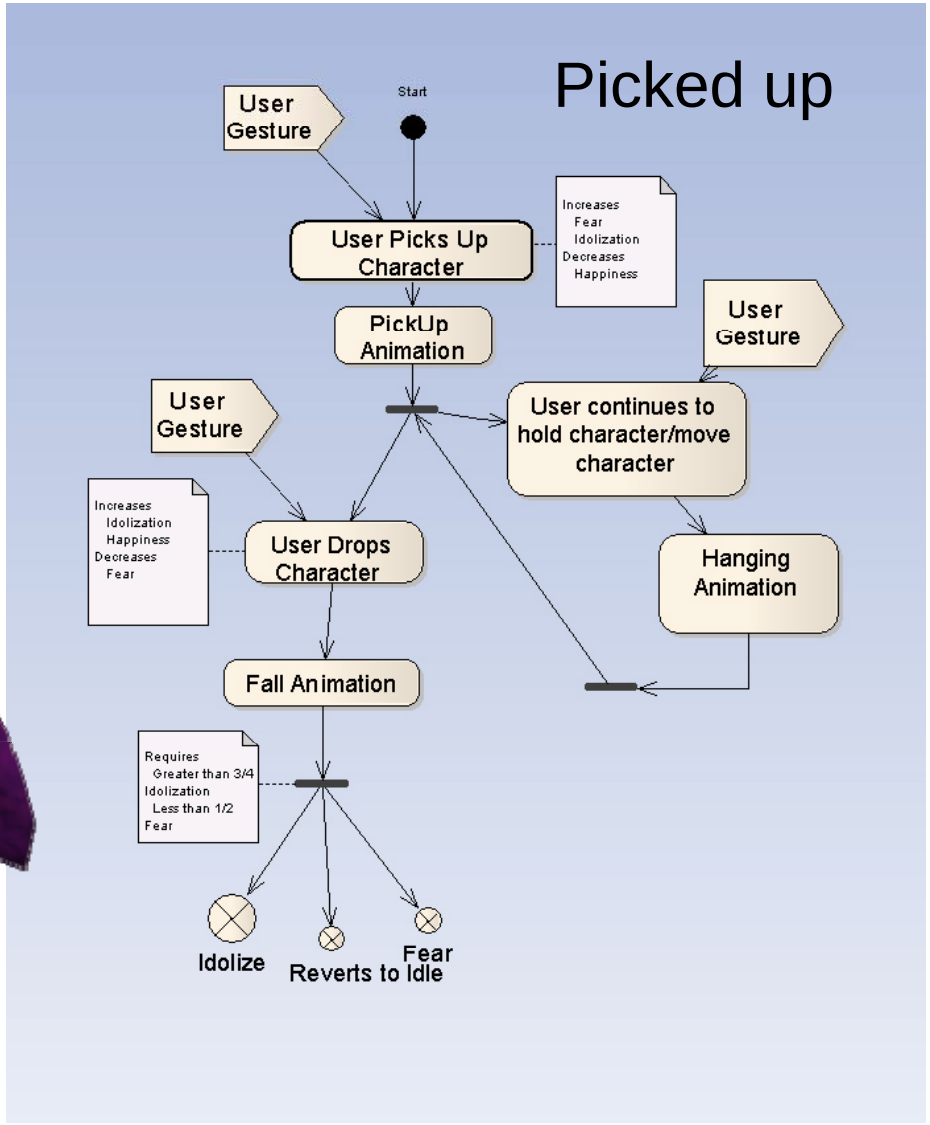
The Diggum



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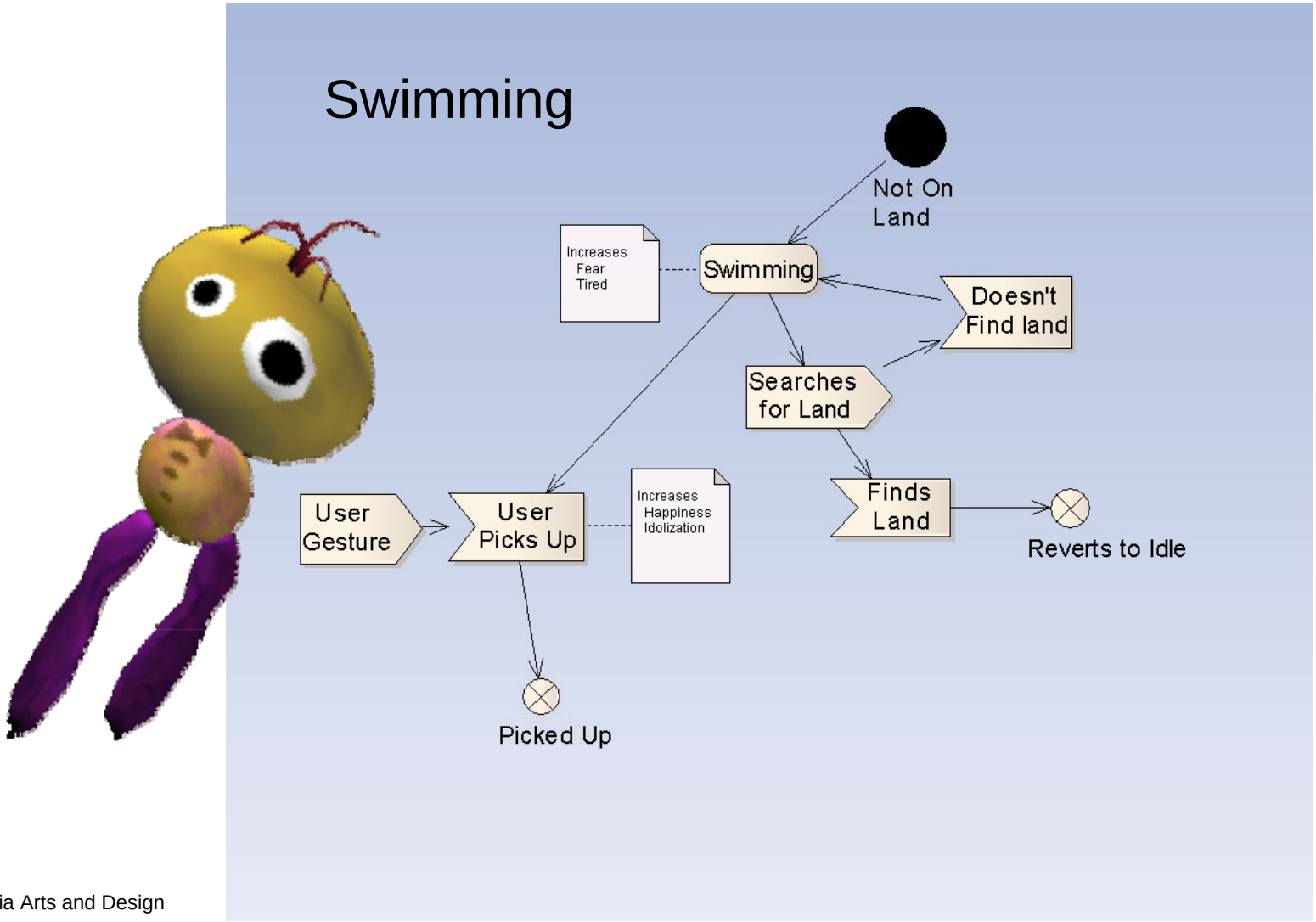
The Diggum



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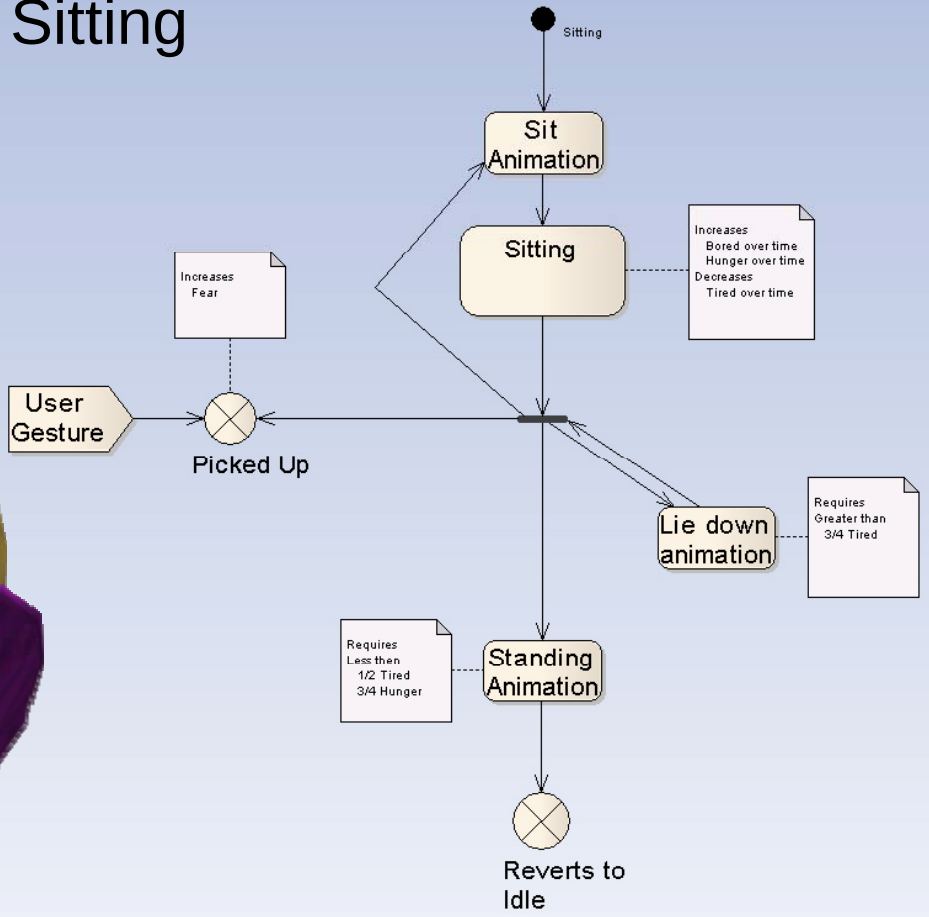
The Diggum

Sitting



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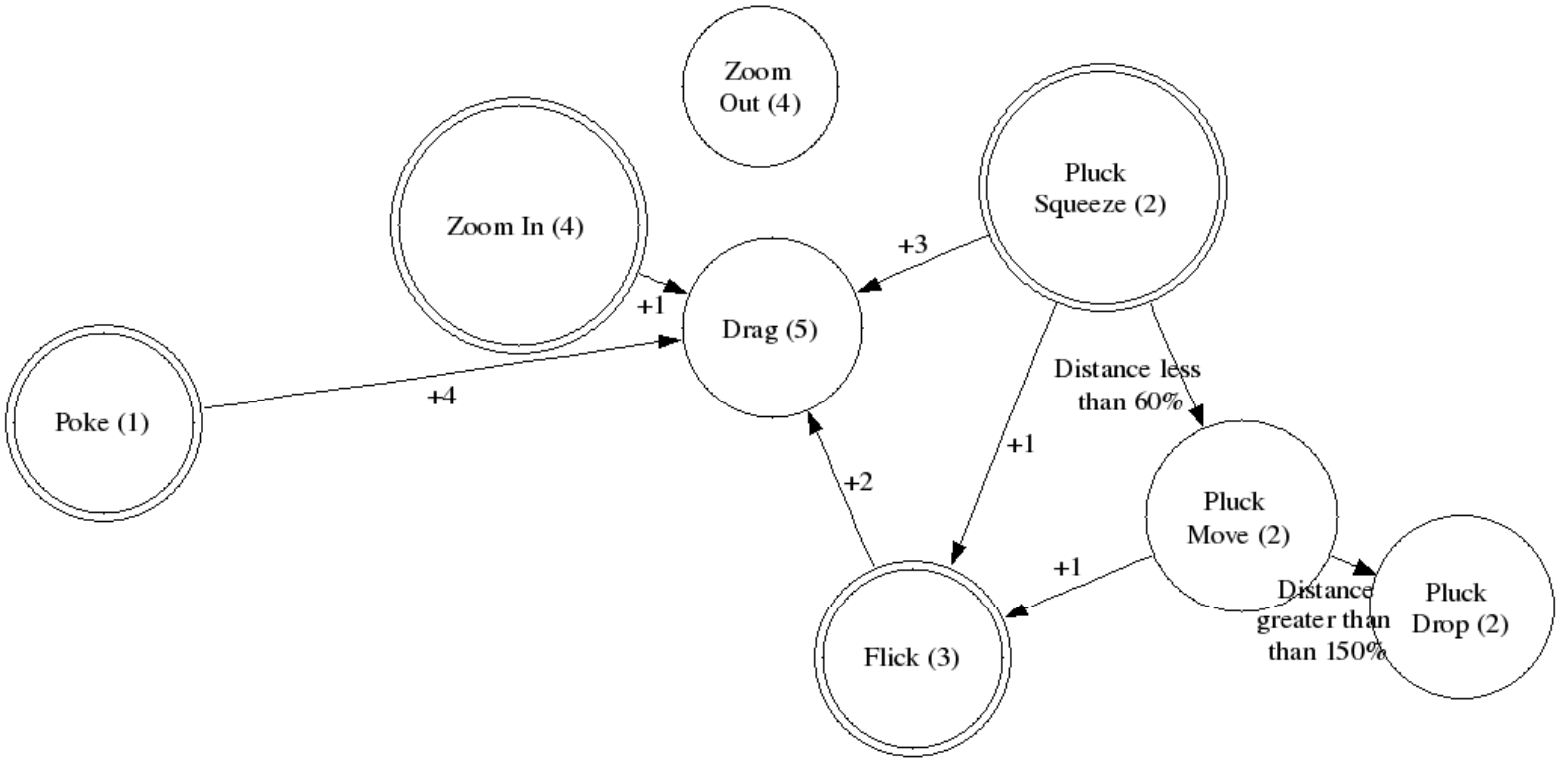
Gestures

- Poke
- Grab ‘n’ Drag
- Slingshot
- Zoom in/zoom out
- Five-finger drag navigation

PLANET DOGGUM

Gestures



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Future Work

- Gross gesture recognition
  - Experimentation needed to determine whether SATIN will be suitable for our needs
    - Downsides: heavily reliant on Java2D and Swing, currently does not natively support multiple users
    - Alternatives: Microsoft Tablet SDK, in-house HMM library by Louis Kratz
- Recording and analysis of user input to refine recognition
- Address tracking latency

PLANET DOGGUM

The Team

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