Mid-Term Eval update

- Thanks for the compliments and constructive criticism
- How the course is going to change as a result:
  - no more crossword puzzle quizzes
  - watch the time closely
  - more group work
  - more focussed card questions
  - post Assignment #3 grade estimate

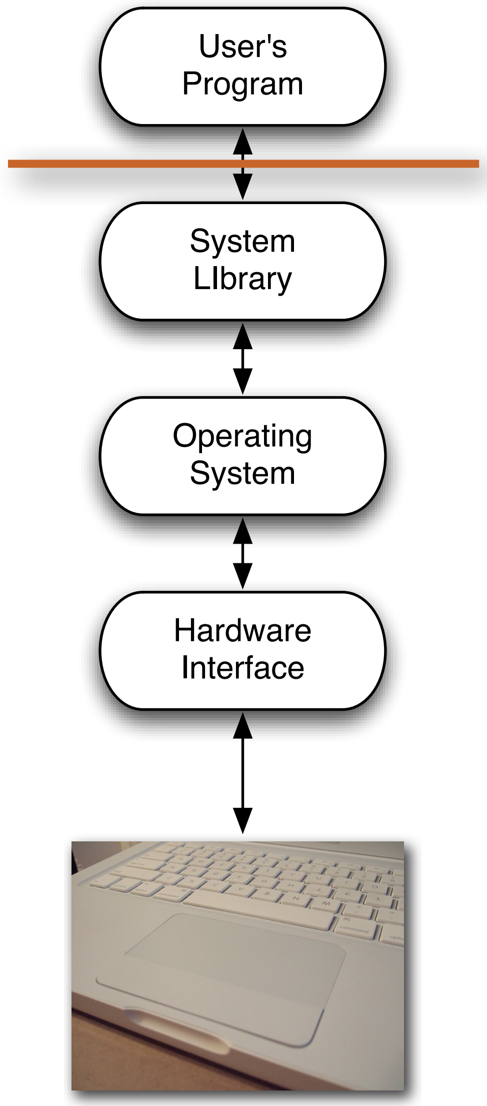
Code to recenter map

```
<button onclick="map.setCenter(centerPoint)">Recent Map</button>
```

User Interaction: Intro to Multi-Touch Tools

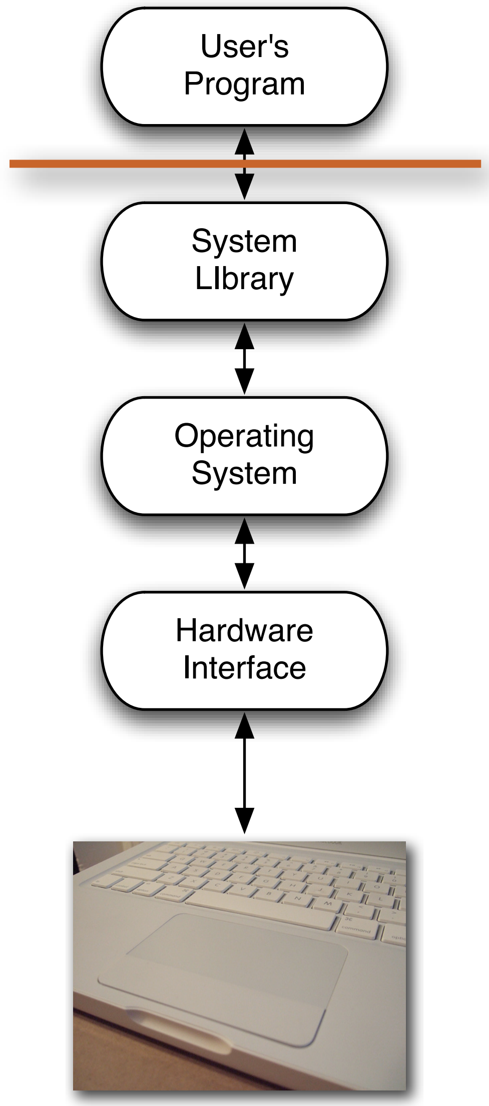
Asst. Professor Donald J. Patterson
INF 133 Fall 2011

Multi-Touch Approach #1



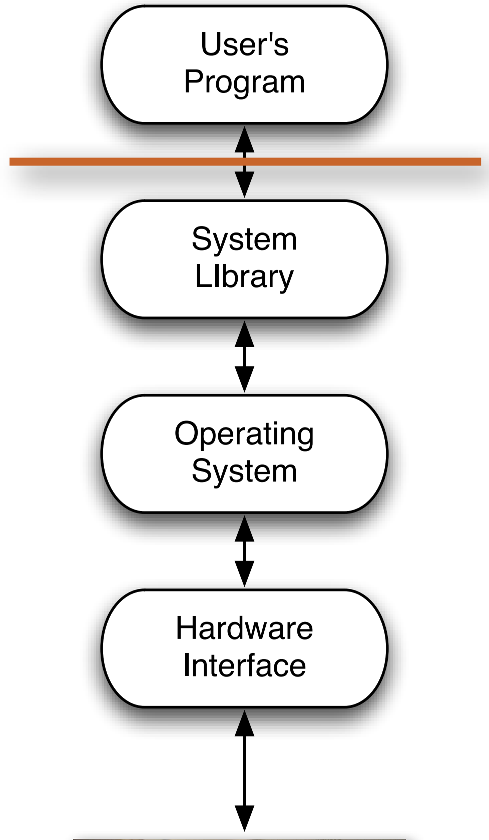
- Design specific multi-touch/gesture events that you can register for:
  - Pinching movements (in or out)
    - meaning zoom out or zoom in
  - Rotate: Two fingers moving in opposite semicircles is a gesture meaning rotate.
  - Swipe: Three fingers brushing across the trackpad surface in a common direction.
  - Scroll: Two fingers moving vertically or horizontally is a scroll gesture.

Multi-Touch Approach #1

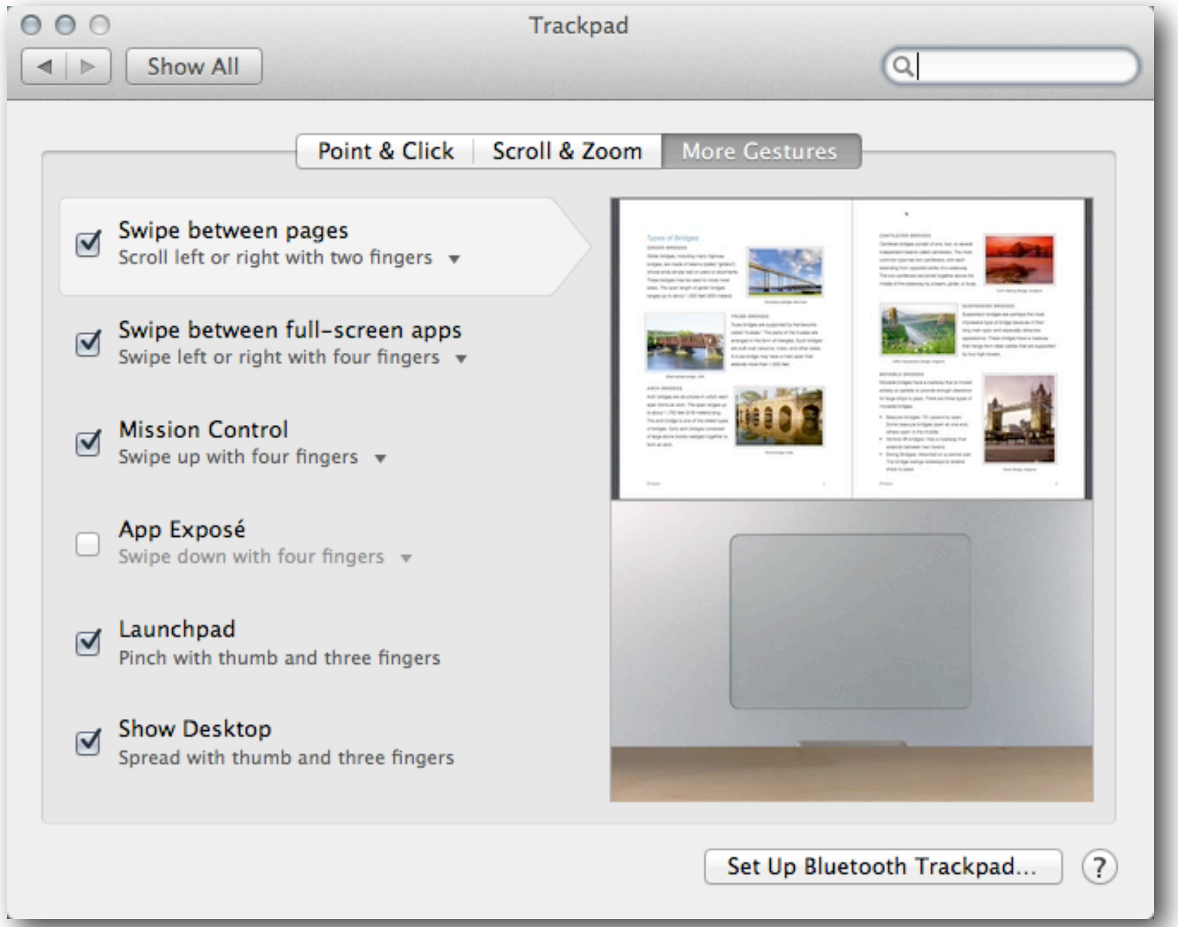


- Advantages:
  - Simple to code
  - Library/OS does all the work
- Disadvantages
  - No flexibility
  - Limited to supported events

Multi-Touch Approach #1

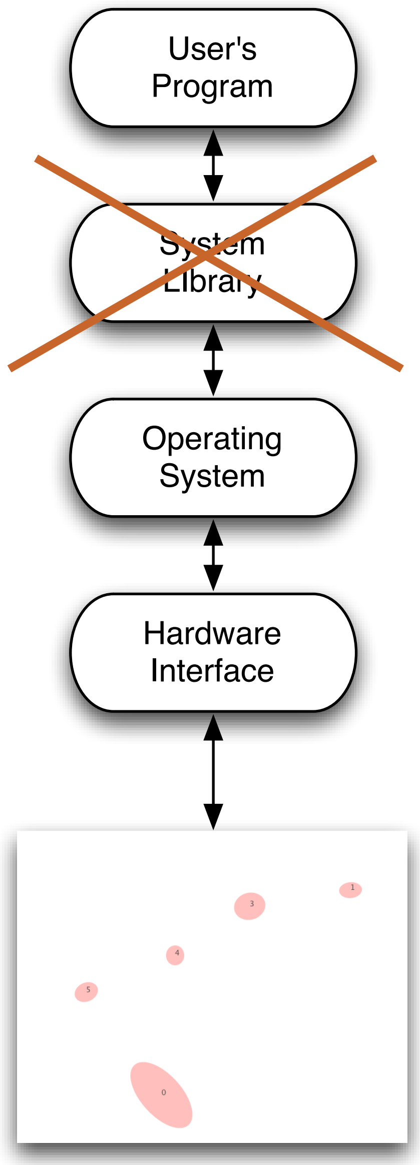


- Examples (demo):
  - Document browsing in Preview
    - Zoom
    - Scale
    - Swipe



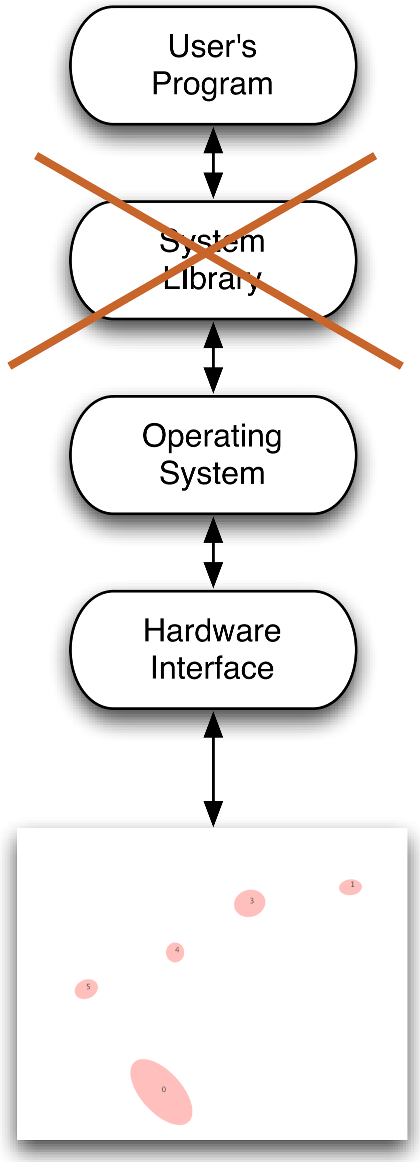
- [✓] Swipe between pages — Scroll left or right with two fingers
- [✓] Swipe between full-screen apps — Swipe left or right with four fingers
- [✓] Mission Control — Swipe up with four fingers
- [ ] App Exposé — Swipe down with four fingers
- [✓] Launchpad — Pinch with thumb and three fingers
- [✓] Show Desktop — Spread with thumb and three fingers

Multi-Touch Approach #2



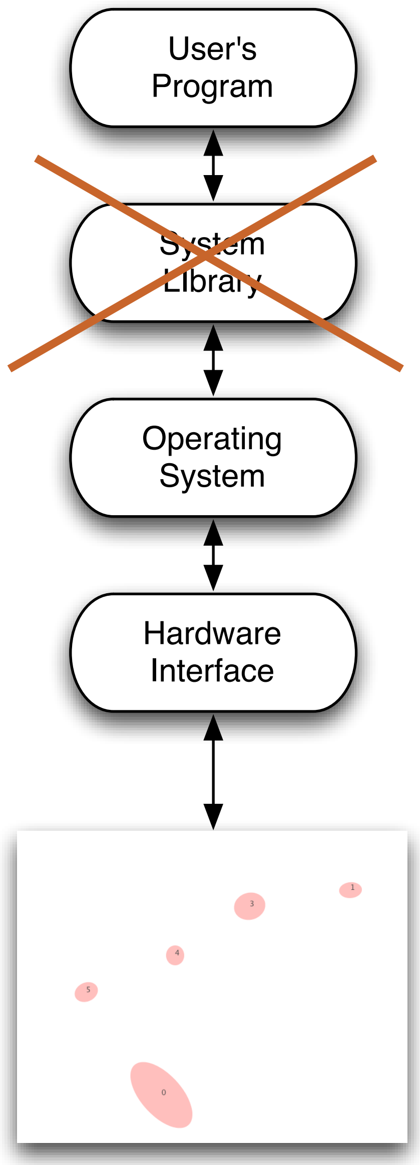
- Blob tracking by program
  - A program receives information about the location/"pressure"/orientation of multiple touches
  - Each touch gets an id to uniquely identify it
  - This is a stream of data
    - continuously updating locations and ids

Multi-Touch Approach #2



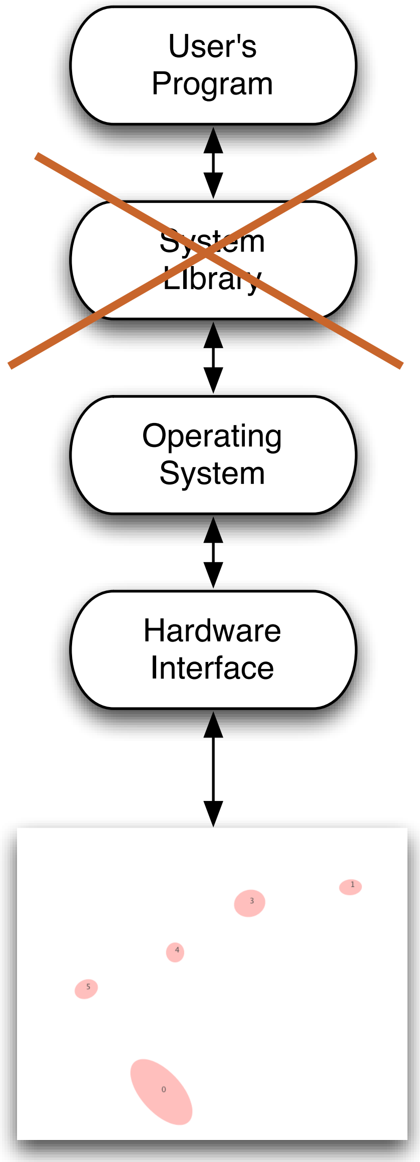
- Advantages
  - Supports unlimited numbers of touches
    - two hands / multiple people
  - Programs can have gestures that make unique sense for them
  - OS does a lot of work to find and report blobs

Multi-Touch Approach #2



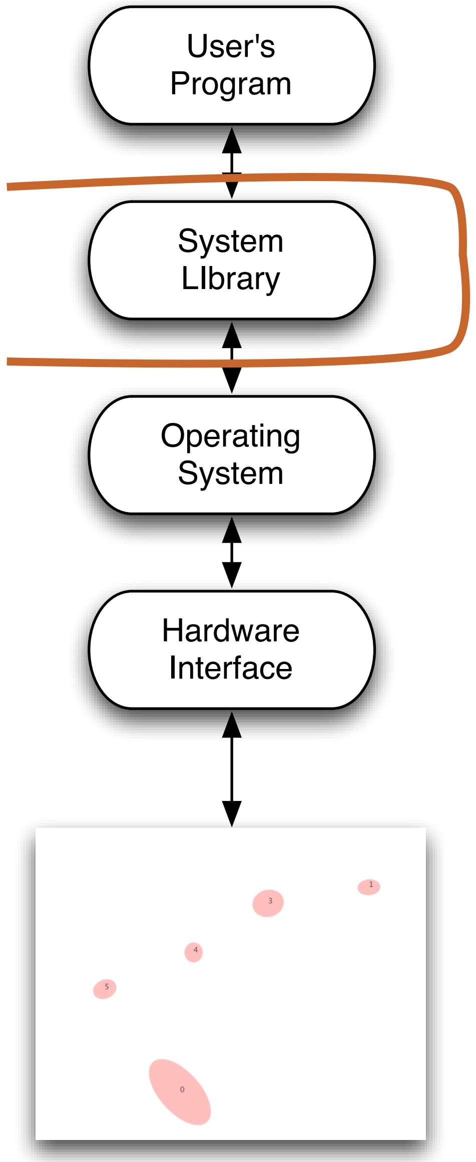
- Disadvantages
  - Each program has to figure out all events itself
    - Was that a pinch?
    - Was that a rotate?
    - Where is the thumb?

Multi-Touch Approach #2



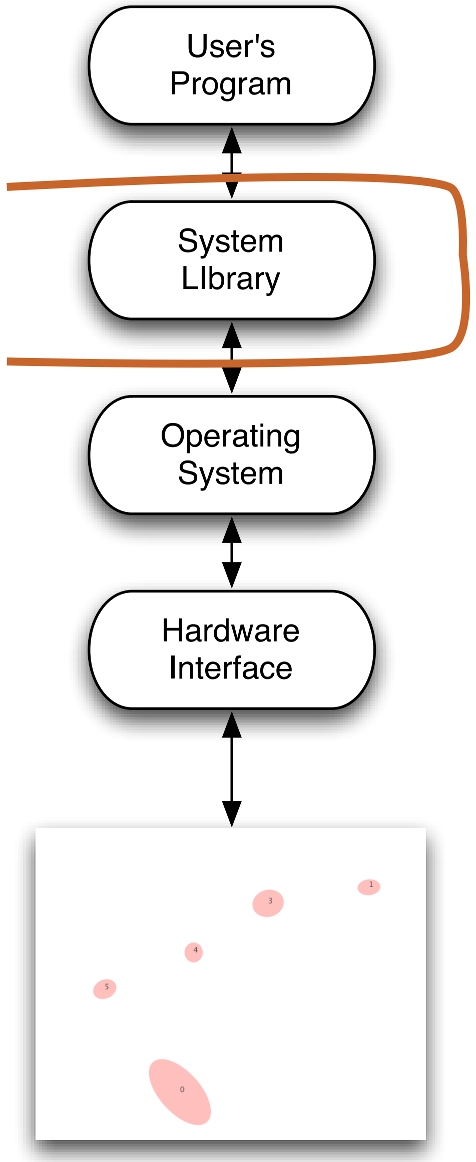
- Examples
    - MacMultitouch Demo
        - FingerMgmt

Multi-Touch Approach #3



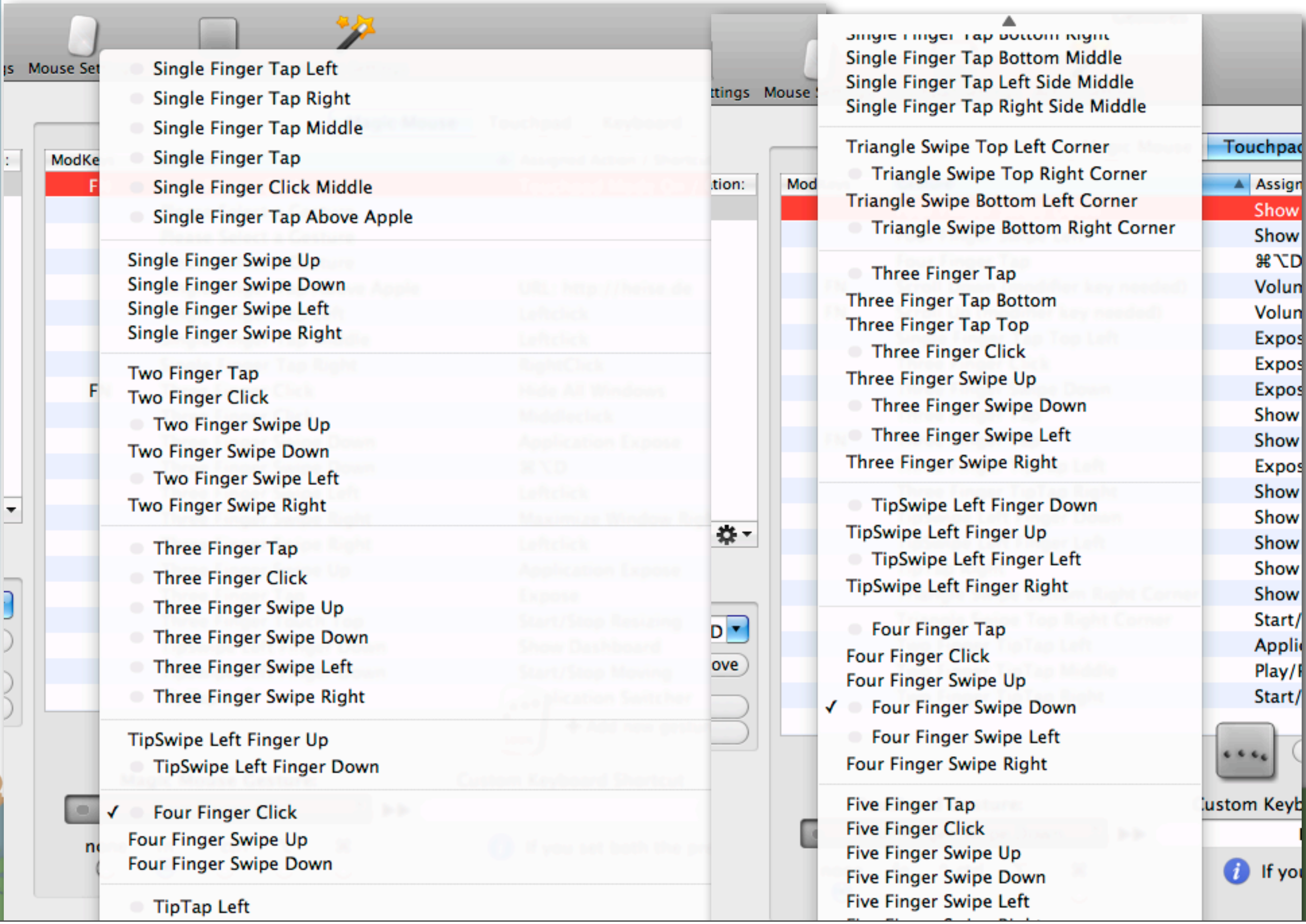
- Create your own event layer for everyone b/c
    - Everyone wants to detect triangle touches
    - Everyone wants to interpret for multiple people
    - Everyone needs a “tiptap” interaction

Multi-Touch Approach #3



- Advantages:
  - Scalable (Other people can use it)
  - Allows completely new interface design
    - "3-finger pinch"
  - Lots of potential for innovation
- Disadvantages
  - Lots to code
  - Limited application support

Multi-Touch Approach #3: Better Touch Tool (http://boastr.net/)



Single Finger Tap Left
Single Finger Tap Right
Single Finger Tap Middle
Single Finger Tap
Single Finger Click Middle
Single Finger Tap Above Apple

Single Finger Swipe Up
Single Finger Swipe Down
Single Finger Swipe Left
Single Finger Swipe Right

Two Finger Tap
Two Finger Click
Two Finger Swipe Up
Two Finger Swipe Down
Two Finger Swipe Left
Two Finger Swipe Right

Three Finger Tap
Three Finger Click
Three Finger Swipe Up
Three Finger Swipe Down
Three Finger Swipe Left
Three Finger Swipe Right

TipSwipe Left Finger Up
TipSwipe Left Finger Down

✓ Four Finger Click
Four Finger Swipe Up
Four Finger Swipe Down

TipTap Left

Single Finger Tap Bottom Middle
Single Finger Tap Left Side Middle
Single Finger Tap Right Side Middle

Triangle Swipe Top Left Corner
Triangle Swipe Top Right Corner
Triangle Swipe Bottom Left Corner
Triangle Swipe Bottom Right Corner

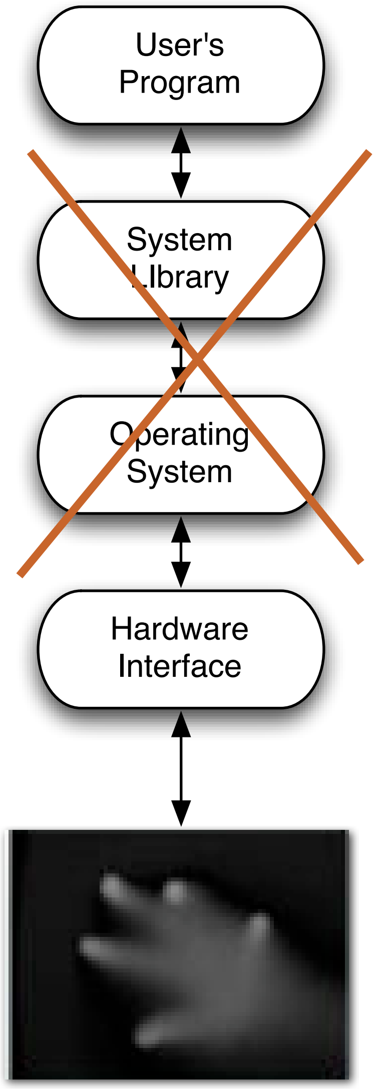
Three Finger Tap
Three Finger Tap Bottom
Three Finger Tap Top
Three Finger Click
Three Finger Swipe Up
Three Finger Swipe Down
Three Finger Swipe Left
Three Finger Swipe Right

TipSwipe Left Finger Down
TipSwipe Left Finger Up
TipSwipe Left Finger Left
TipSwipe Left Finger Right

Four Finger Tap
Four Finger Click
Four Finger Swipe Up
✓ Four Finger Swipe Down
Four Finger Swipe Left
Four Finger Swipe Right

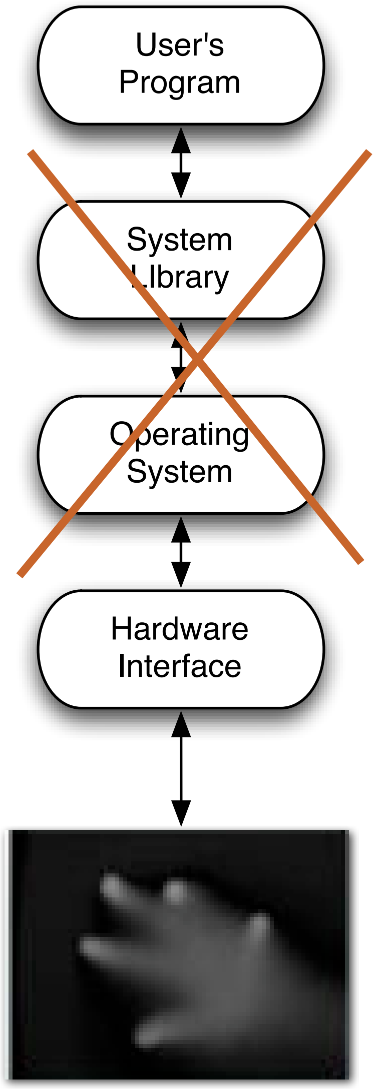
Five Finger Tap
Five Finger Click
Five Finger Swipe Up
Five Finger Swipe Down
Five Finger Swipe Left

Multi-Touch Approach #4



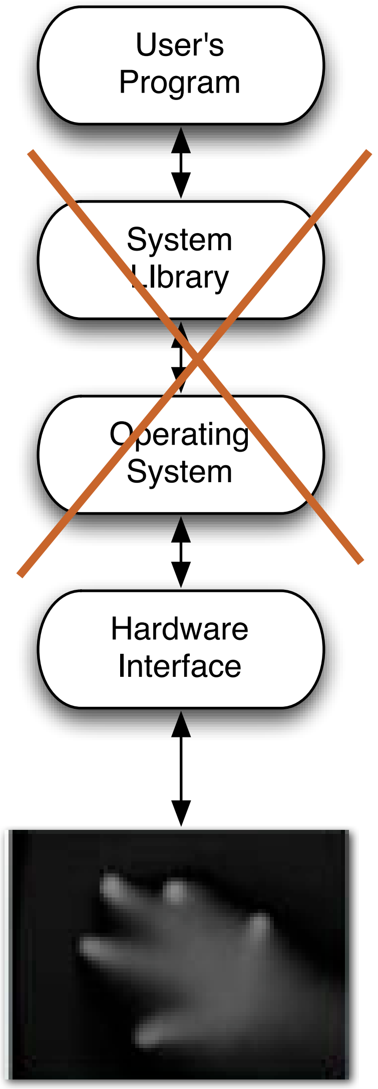
- Grayscale input
  - A program receives a stream of images
  - Darker (or lighter) colors indicates pressure or proximity

Multi-Touch Approach #4



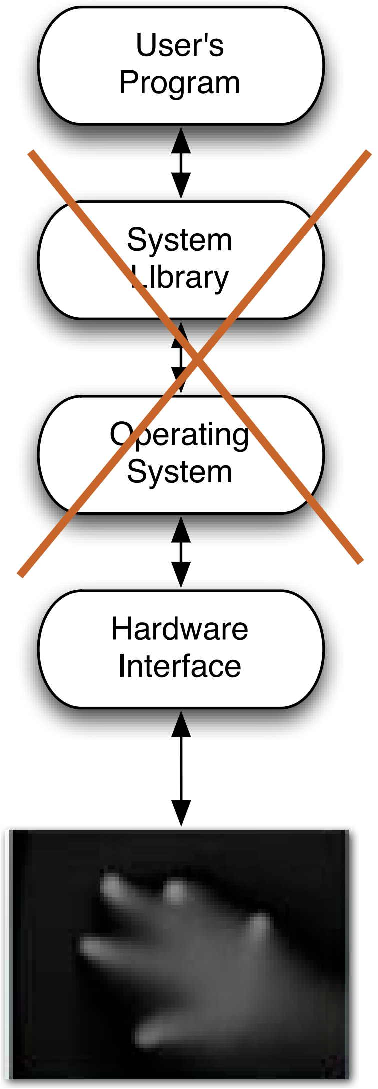
- Advantages
  - Maximum flexibility
  - Not restricted to “finger touch” paradigm
    - Can recognize a “cup down” event for example

Multi-Touch Approach #4



- Disadvantages
    - This is full-fledged computer vision
    - Different technologies generate different quality images
    - Robustly and consistently recognizing events is hard.

Multi-Touch Approach #4

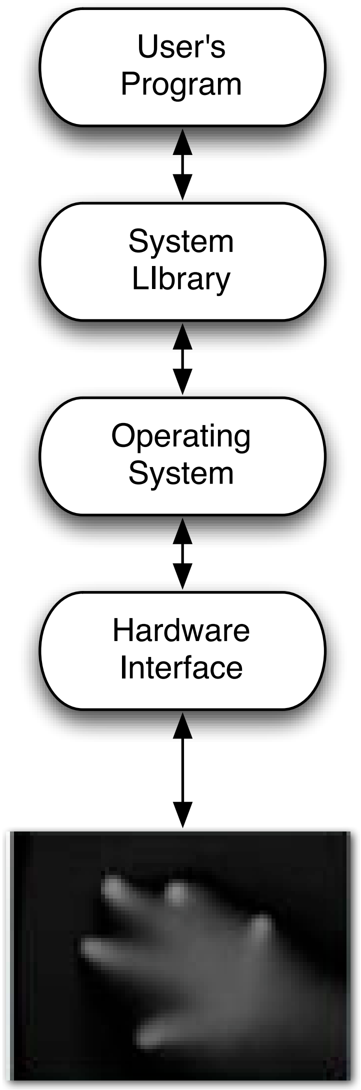


- Examples
  - iShred
    - http://www.youtube.com/watch?v=eZpnzzKbY2I&feature=player_embedded
  - Microsoft Surface
    - http://youtu.be/C36rm5yS4c4

How do you choose?

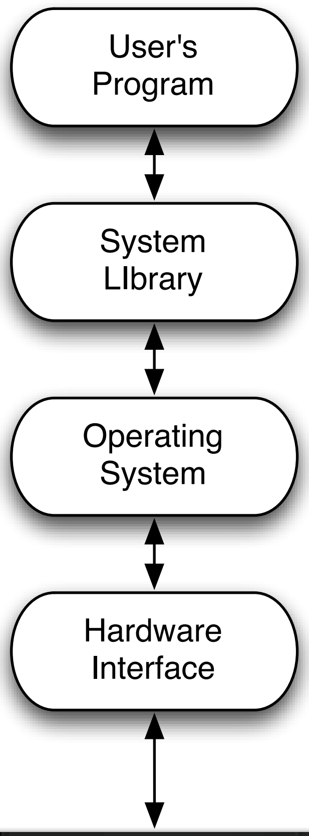
- How fast do you need to get your application done?
  - #1 is fastest, #4 is slowest
- Who are your users?
  - #1 is the most familiar to users, #4 requires users to adapt
- What is your application?
  - #1 is basically point and click extensions
  - #4 supports crazy gaming/applicatinos
- Are you showcasing multi-touch? or supporting a task?

Our assignment



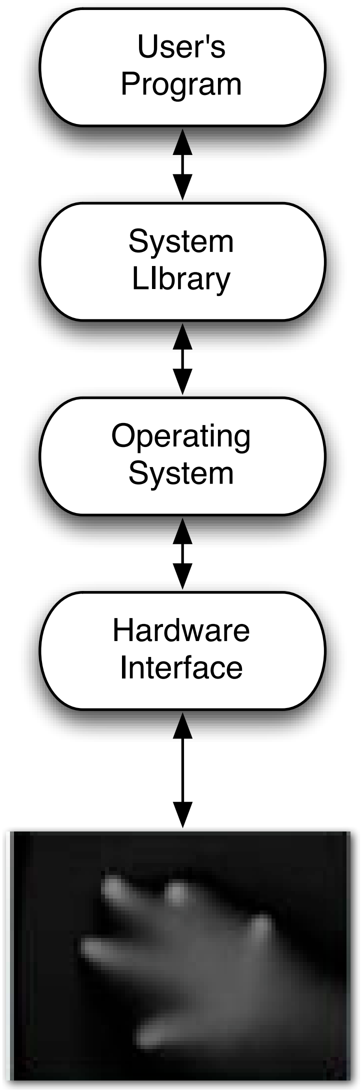
- Build a multi-touch Java paint application
    - No OS support

Our assignment



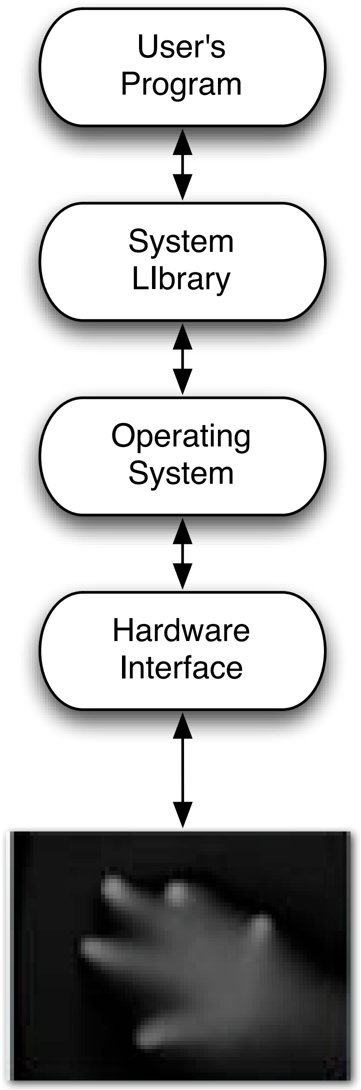
- Where are we going to get a grayscale input?
  - You can build your own
  - You can use prerecorded video

Our assignment



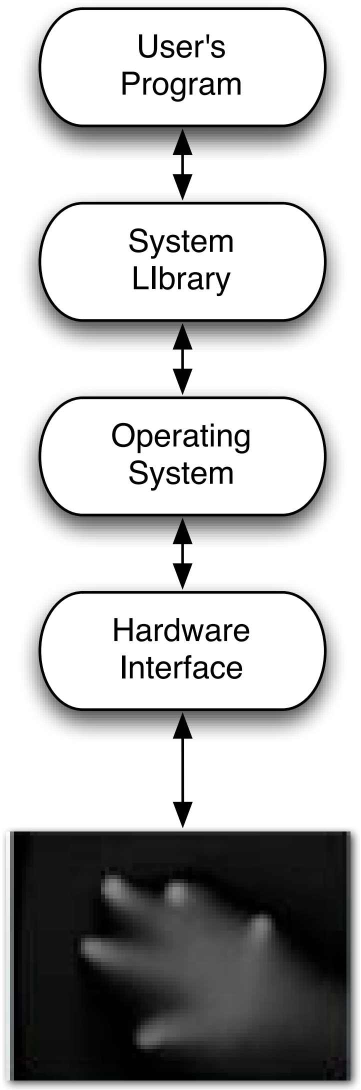
- How will we interface to the computer?
  - Use standard camera inputs

Our assignment



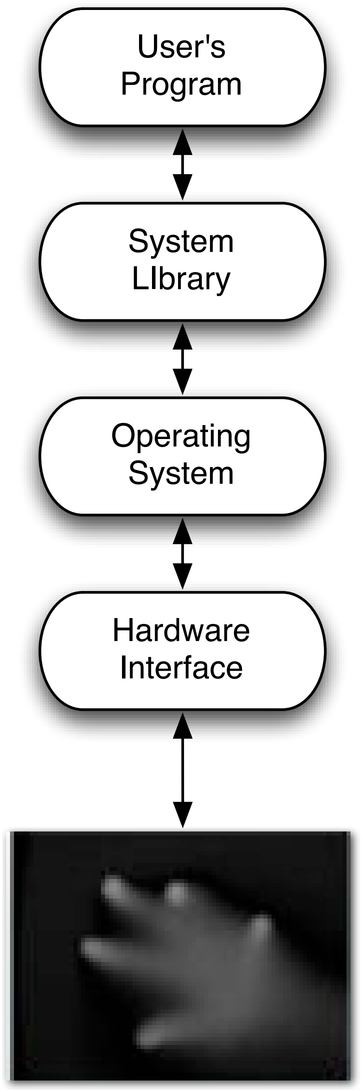
- How will we process it without OS support?
  - We will use Community Core Vision to process the grayscale images

Our assignment



- How will will our application get information about multi-touch events?
  - Using the TUIO standard and a TUIO library for java

Our assignment



- How will I write a multi-touch application?
    - Register for multi-touch events and then respond when you receive them.

LUCI