Teaching Computational Thinking Through Mobile Apps

Workshop
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Sponsored by IBM
Workshop Overview

• Day 1
  - Welcome/Introductions
  - Workshop Overview/App Demo
  - App Inventor 2 / IBM Cloud Tools
  - App 1 & 2 Labs
  - Discussion: Using App Inventor to teach CS Principles
Workshop Overview

• Day 2
  - App 3 Lab
  - Discussion-continued: Using App Inventor to teach CS Principles
  - App 3
  - Wrap-up Discussion
Introductions

• Where are you from?
• What do you teach?
• Why did you enroll in this workshop?
• Your favorite App, and what do you like about it?
What is This Workshop About?

- How do mobile apps work? *Programming*
  - Lab Projects (3)

- What can be created using methodologies from computing and computer science? *Creativity*
Workshop Goals

• Explore the context for mobile computing
• Learn the fundamentals of coding mobile apps
• Understand the app development workflow (tools such as App Inventor & other resources)
• Gain proficiency in the foundations of user interface design
• Examine the app distribution process
• Explore the use of App Inventor in CS Education

Have Fun!
Workshop Documents

I ❤️ Candy Demo
I ❤ Candy Workflow

• Text my mobile phone “I ❤ Candy”
• My phone receives text and stores your phone number in a data list
• When I press the button in my I ❤ Candy app, the app randomly picks a phone number from the list and places a call to the winner

AI2 Program
I ❤️ Candy!

To...

(919) 908-4105
App Inventor for Android

Do-it-yourself App Creation
Developing Mobile Apps

• iPhone
  – Swift/Objective C
  – High level tools to turn pre-existing content into an app.
    (e.g., http://www.appmakr.com/learn_more/)

• Android
  – Java
  – App Inventor

• Web-Based Apps
  – App Lab (CODE.org https://code.org/educate/applab)
  – Bitsbox.com
  – Tickle (iOS App)
App Inventor 2

- Blocks language, like plugging in puzzle pieces
- Similar to Scratch, but for phones
- Like an “electronic napkin” for prototyping apps
- Democratizes app building
An App Inventor App

What do you think this app does?

when Button1.Click
do call TextToSpeech1.Speak
message "Congratulations! You've made your first app."

What do you think this app does?
Brief History of App Inventor

• Summer 2009
  – Hal Abelson of MIT and Google
  – Pilot program with 10 schools
  – Public launch July 2010
  – App Inventor 2 beta release Nov. 2013
Why Is It So Easy?

• **No syntax.** The blocks language eliminates the need to remember and type code.

• **Everything is right in front of you.** Components and functions are in drawers. Just find, drag, and drop.

• **Events at top level.** "When this happens, the app does this" is the correct conceptual model.

• **High-level components.** The app inventor team has built a great library with simplicity the main goal.

• **Only some blocks plug-in.** You can't do things that don't make sense.

• **Concreteness.** Less abstract than many languages.
Apps Students Have Built

- Quizzes, surveys, study guides
- Restaurant guides
- Droid Where’s my car?
- Broadcast Hub
- Bus Tracker
- Games
Trinity College students made an app to Estimate Tree Height
MIT students made an app to help Diabetics test their blood sugar

ComPal
Combur Urine Test Analyzer

Bringing medical testing to the developing world

Analyze Combur urinalysis test strips using popular mobile devices

Identify signs of serious diseases in time for treatment

Adapt ComPal’s flexible framework to other popular medical tests

Emily Kuo  Bradley Wu  Angela Chang
A U.S. Marine made an app to compute the amount of explosives needed to destroy IEDs.
What You Can Build

- Educational apps
  - Including video, images, text-to-speech
- Location-aware apps
- Games
- Robot Controllers
- Web-enabled apps
- Personal apps
Resources

- Books
- AI2 website - http://appinventor.mit.edu/explore/
- Google for Help/Tutorials
- YouTube Video Tutorials
Questions?
Softlayer VCL Support for App Inventor
Questions We'll Answer

- What is Softlayer VCL?
- How does it Work?
- What can VCL can do for Instructors using App Inventor?
- Demo
Soft layer VCL

• What is it?
  • A Computing Environment (Desktop) Delivery Service (ie., Cloud Computing)
  • Remote Access to High-End Software
  • Anytime, Anywhere, On Demand Computing
What is Softlayer VCL?

- Represents a transformation in the business of education -- a transformation in how education is delivered
Motivation

- Shared Compute Resources (Always On)
- Custom Compute Environments (Can be Saved and Recalled at a Later Date)
- "Distributed" Education
- Increased Utilization of Hardware, While Meeting the Needs of Teachers and Students
Development Partners

- **Academic**
  - Duke University
  - ECU
  - Johnston Community College
  - NCCU
  - NCSU
  - UNC - CH & G
  - Wake Tech Community College
  - Western Carolina University

- **Industry**
  - IBM
  - Intel
  - Sun Microsystems
  - NetApp

- **Government Agencies**
  - North Carolina Community College System
How Softlayer VCL Works

Client Computer

Public Internet

Operating System & Application Screen

VCL Servers
Value for Instructors

- Update one (the VCL), run many (student machines)
- Shared Libraries
- Ubiquitous Access
- Shared Resources, Help Files, etc.
- CIPA Compliant (per Durham Public School District Standards)
VCL Nuts and Bolts

- Web Reservation Interface http://www.vclsoftlayer.com
- Account Required
- Individual or group reservations
- Software Licensing Issues???
Authentication Method

- Select "Local Account", and then "Proceed to Login"
Authentication Method

Enter Account Credentials

Userid: lucie
Password: ************
Reservation Screen

Windows 7 Pro (for Duke Camp)
Reservation Pending

Current Reservations

You currently have the following normal reservations:

<table>
<thead>
<tr>
<th>Environment</th>
<th>Starting</th>
<th>Ending</th>
<th>Initially requested</th>
<th>Req ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 7 Enterprise (SoftLayer KVM)</td>
<td>Tuesday, Jun 7, 2016, 3:49 pm</td>
<td>Tuesday, Jun 7, 2016, 5:00 pm</td>
<td>Tuesday, Jun 7, 2016, 3:49 pm</td>
<td>6233</td>
</tr>
</tbody>
</table>

This page will automatically update every 20 seconds until the Pending... reservation is ready.
Ready to Connect
Connection Info for RDC

Connect to reservation using Remote Desktop for Windows or Linux

You will need to use a Remote Desktop program to connect to the system. If you did not click on the Connect! button from the computer you will be using to access the VCL system, you will need to return to the Current Reservations page and click the Connect! button from a web browser running on the same computer from which you will be connecting to the VCL system. Otherwise, you may be denied access to the remote computer.

Use the following information when you are ready to connect:

- **Remote Computer:** 169.55.144.70
- **User ID:** lucic
- **Password:** 4xSyPm

NOTE: The given password is for this reservation only. You will be given a different password for any other reservations.

For automatic connection, you can download an RDP file that can be opened by the Remote Desktop Connection program.
Connect RDC to VCL Windows 7 Environment

DIFFERENT THAN ACCOUNT PASSWORD!
Windows 7 Environment
Softlayer VCL Workflow

- Launch RDC (for Mac, download from Microsoft)
- Go to http://www.vclsoftlayer.com and make a reservation
- Environment = Windows7 Pro (for Duke Camp)
- Log into environment using RDC and the credentials provided by the VCL website
Demo
Lab Work
Set-up

- Register for a Google account if you do not already have one.
- If you do not have an Android phone, you will have to install the Android emulator on your computer.
- If you do have an Android phone, you will need to install the App Inventor Companion. You will also need a QR Code Reader.

http://appinventor.mit.edu/explore/ai2/setup.html
Try It!

• Go to: http://appinventor.mit.edu/explore/get-started?

• Register and get started
  – Download software
  – Try Hello Blue Devil
  – Use phone or emulator

• Help-- sites:
  – http://appinventor.mit.edu
  – appinventor.org
Hello Blue Devil App #1

- Learn the App Inventor 2 IDE
- Designer UI
  - Components - Properties
- Blocks Editor UI
- Connecting an Android device or Emulator
Hello Blue Devil App #1

- Bonus Challenges
  - Add App Icon
  - Accelerometer Sensor Responds to Shaking Event
  - Text to Speech
  - Vibrate Phone when button is clicked
Using App Inventor to Teach CS Principles
Computational thinking is recognized as a key skill set for all 21st century learners, whether they intend to continue with Computing Science or not. It involves a set of thinking practices through which to view the world:

- seeing a problem and its solution at many levels of detail (abstraction);
- thinking about tasks as a series of steps (algorithms);
- understanding that solving a large problem will involve breaking it down into a set of smaller problems (decomposition);
- appreciating that a new problem is likely to be related to other problems the learner has already solved (pattern recognition);
- realizing that a solution to a problem may be used to solve a whole range of related problems (generalization).
Computer/Smart Phone
Key Concepts

• They are **deterministic**: they do what you tell them to do.

• They are **precise**: they do exactly what you tell them to do

• Computers/Smart Phones can therefore be understood; they are just machines with logical working
Phone Internals

iPhone

Android
Coding for Mobile Apps

App Inventor 2

Android Studio

Xcode

Blocks

Java

Swift
Why Mobile App Development

• Desktop metaphor formed most users’ experience of Computing. The resultant applications became the mainstay of the CS curriculum and informed much of what was taught.

• Today’s learners have a different experience of Computing: it is on-line, social and increasingly mobile. Computing devices have become more tactile and personal, the result of convergence of numerous technologies from multi-touch to motion-sensing and GPS.
Why Mobile App Development

- The experience will engage students in a way that is relevant to their own digital lives
- Give students skills to be creators rather than just consumers of mobile technology
- It's an increasingly mobile world: mobile business, mobile medicine, mobile entertainment, etc.
"Today, your cell phone has more computer power than all of NASA back in 1969, when it placed two astronauts on the moon."

IBM System 360 Model 75 ($3.5M)

Cray-2 ($16M) World’s fastest supercomputer until 1990 achieved a performance of 1.9 GFLOPS

Samsung Galaxy S5 and iPhone 5S operate at roughly 100 GFLOPS
CompSci 89s

- A Gentle Introduction to Creating Mobile Apps
  - First Year Seminar (18 Students)
  - No Prior Coding Experience Required
  - Goal is to Attract Students to a CS Major
Seven Big Ideas of Computer Science

- Abstraction
- Algorithms
- Data & Information
- Programming
- Creativity
- Internet
- Impact
CompSci 89s Syllabus

• Learning Unit 1: Preview and Setup

• Learning Unit 2: Mobile Computers & Apps (Big Ideas, Abstraction, Binary Numbers, Conditionals)

• Learning Unit 3: Graphics, Location, and Lists

• Learning Unit 4: Advanced Topics (Procedures & Loops, Engineering & Debugging Apps, Random Numbers, Searching & Sorting, App Distribution)

• Learning Unit 5: Data, Databases, and Information
CompSci 89s Deliverables

- Project Portfolio
- 9 App Tutorials + Semester Project
- Weekly Checksheet
- Student-Led Reading Discussion
- Midterm, Final, and 2 Quizzes
Richard Tseng
Fall 2015
Resources for Teachers

- App Inventor Website (Resources) - [http://appinventor.mit.edu/explore/](http://appinventor.mit.edu/explore/)

- Mobile CSP - [http://mobile-csp.org](http://mobile-csp.org)

- Teaching with App Inventor - [http://appinventor.mit.edu/explore/teach.html](http://appinventor.mit.edu/explore/teach.html)
  [http://teach.appinventor.mit.edu](http://teach.appinventor.mit.edu)

Paint Pot App #2

- Understanding of Event-Driven Programming
- Drawing & Animation
Paint Pot App #2

- Bonus Challenge
  - Add App Icon