Developing Applications for iOS

Lecture 1:
Mobile Applications Development

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Evaluation

- Grade options (either one):
  1) 100% individual project
  2) 100% final exam (paper test)*
  (*) + 0.2p per lab attendance (up to 1p)
- In both cases, grade must be greater than 5
Content

- Key concepts of mobile applications development
- Limitations of mobile devices
- Features of mobile devices
- General advices
- Overview of the mobile environments
- Requirements
- iOS Overview
- iOS Technology Layers
Introduction

- Mobile applications development is the process of building software applications for small handheld devices such as mobile phones, personal digital assistants, tablets, etc.
Introduction

• Platforms for mobile applications: Android, iOS, Windows Mobile, etc.

• Mobile applications are pre-installed on phones during manufacturing, or downloaded by customers from various mobile software distribution systems:
  App Store (iOS)
  Google Play Store (Android)
  Amazon Appstore (Android)
  Microsoft Store (Windows Mobile), etc.
Key concepts

- Smartphones and tablets are becoming the computer of choice for more and more people.

- Despite the attention paid to mobile development in the last years, a lot of developers still lack the basics when it comes to building mobile applications.

- Many developers are just used to the desktop / web.
Key concepts

- Even if it may seem easy to make an application, it is hard to create a “good user experience”.

- Mobile devices have different limitations and features compared to the desktop computers.

- The emergence of mobile devices and their smaller screens means some serious adjustments in perspective.
Key concepts

- We need to make a transition to a new perspective.
Limitations of mobile devices

- Smaller screen:
- Instead of building for large PC screens (13 to 27 inches wide), developers could be dealing with a 4 to 6 inches wide Android, iPhone or BlackBerry screen.
- Because of the screen size constraint, every pixel counts to some degree.
- Even the iPad's larger screen (7.3 by 9.5 inches) needs to be considered differently because the screen resolution is still less that of most desktop monitors.
Limitations of mobile devices

- Less memory and bandwidth:
- Mobile devices really do not have a lot of memory.
- Although a typical PC can have 8-16 GB of memory, a smartphone might have just 512 MB.
  (e.g.: developers loading 100 images of 10 MB onto a phone would quickly run out of memory)
- Network connectivity for smartphones and tablets incurs limits on downloading.
- Memory, space and battery life are some of the parameters that have to be taken into account when you develop all your apps.
Limitations of mobile devices

- Different user interaction:
  - Mobile devices have no mouse. The physical keyboard is much smaller or even missing.
  - This means mobile applications don't respond to double clicks or keyboard shortcuts.
  - Most smartphones can interact using touch screens or capacitive displays. This can also be a feature.
Features of mobile devices

- Better user interaction:
  - Most smartphones can interact using touch screens or capacitive displays.
  - Capacitive displays enable the use of multi-touch gestures which allow a natural interaction with the device.
    (e.g.: pinch-open to zoom in, pinch-close to zoom-out, swipe to delete, etc.)
Features of mobile devices

- Using multi-touch gestures

https://www.youtube.com/watch?v=TB5nnMZlZUM
https://www.youtube.com/watch?v=flR6mz788h0
Features of mobile devices

• Using built-in devices:

• Most smartphones have built-in devices such as: camera, accelerometer, gyroscope, GPS, compass, etc.

• Mobile applications should make use of this capabilities whenever this is possible.

• E.g.: detecting the device orientation using the accelerometer (to adjust the display) can be used for creating a better user experience.

• E.g.: building augmented reality applications requires the GPS, the compass, the camera and even the accelerometer.
Features of mobile devices

- Using built-in devices for mobile applications
General Advices

- Focus on user experience: reduce navigation for users, go with defaults, remember what users did last time.

- Choose carefully between native and web development: web-based development is less expensive and not as complex, but it doesn't deliver the kind of experience the user might expect.

- Think about how to take advantage of location: location services enable developers to offer a more customized experience.
General Advices

- **Design and code for touch interfaces:** developers need to understand the user flows first, then translate the basis of touch interfaces into coding language.
- **Expect users to make mistakes:** developers should anticipate users pressing the wrong buttons.
- **Smaller size of smartphones and unfamiliar users guarantee input mistakes.** Mobile applications should be more tolerant and recover without extra effort.
“Simple can be harder than complex: You have to work hard to get your thinking clean to make it simple. But it’s worth it in the end because once you get there, you can move mountains.” - Steve Jobs
Overview of the mobile environments

- Each of the platforms for mobile applications has an IDE which provides tools to allow a developer to write, test and deploy applications into the target platform environment.

- An alternative to native applications are web-based mobile applications which are less expensive to build. This alternative represents a trade-off between cost and user experience, e.g. we will not be able to use all device capabilities.
Android

- Developers can use the Android Studio IDE to build applications using the Kotlin or Java programming languages.
- Android is based on a Linux kernel with libraries and APIs written in C.
- There are more than over 1 million apps available for Android, that can be downloaded from online stores such as Google Play Store.
Windows Phone

- Developers can build applications with Visual Studio 2010 IDE using the C# programming language.
- Windows Mobile is the successor of Windows Phone. It's a newer mobile operating system compared to Android and iOS.
- The applications are available in the Microsoft Store.
iOS

- Integrated with Xcode IDE. Developers must have Intel-based Mac computers and the latest Mac OS X installed.
- iOS applications can be developed using an open-source programming language, called Swift. This is a modern OOP language designed to be more concise than Objective-C.
- iOS is based on a UNIX kernel with libraries written in C, Objective-C and Swift.
Requirements

- Must have an Intel-based Mac with MacOS 10.11.5 or later and Xcode 8.2.1.
- Hardware:
  iPhone 4 or later, iPod Touch 4th Generation or later, iPad 2 or later
- Textbook:
  Apple online documentation
  https://developer.apple.com/develop/
- Prerequisites:
  Object-Oriented Programming Principles
Requirements

Object-Oriented Terms:

- Class (description/template for an object)
- Instance (manifestation of a class)
- Method (code invoked on an object)
- Instance Variable (object-specific storage)
- Inheritance (code-sharing mechanism)
- Superclass/Subclass (Inheritance relationships)
- Protocol (non-class-specific method declaration)
What will I learn in this course?

- **How to build cool iOS apps:**
  Easy to build even for very complex applications.
  Join a vibrant development community.

- **Real-life Object-Oriented Programming:**
  The heart of Cocoa Touch is 100% object-oriented.
  Application of MVC design model.

- **Many computer science concepts applied in a commercial development platform:** Databases, Graphics, Multimedia, Multithreading, Animation, Networking and much more.

- **We want you to be able to go on and sell products on the AppStore.**
iOS Overview

- iOS comprises the operating system and technologies that you use to run applications natively on devices, such as iPad, iPhone, and iPod Touch.

- Although it shares a common heritage and many underlying technologies with Mac OS X, iOS was designed to meet the needs of a mobile environment, where users’ needs are slightly different.

- Some technologies are available only on iOS, such as the Multi-Touch interface and accelerometer support.
iOS SDK Overview

- The iOS SDK contains the code, information, and tools you need to develop, test, run, debug, and tune applications for iOS.
- Xcode provides the launching point for testing your applications on an iOS device, and in iOS Simulator.
- iOS Simulator is a platform that mimics the basic iOS environment but runs on your local Macintosh computer.
Platform Components

- Tools
- Language
- Frameworks
- Design Strategies

label.textColor = UIColor.blueColor()

Frameworks:
- Core Data
- Core Motion
- Foundation
- Map Kit
- UI Kit

Design Strategies:
MVC
iOS SDK Overview

- Xcode and iOS Simulator:
iOS Technology Layers

- The kernel in iOS is based on a variant of the same basic Mach kernel that is found in Mac OS X.
- On top of this UNIX kernel are the layers of services that are used to implement applications on the platform.
- This layering gives you choices when it comes to implementing your code.
iOS Technology Layers

- The Core OS and Core Services layers contain the fundamental interfaces for iOS, including those used for accessing low-level data types, network sockets, and so on.

- On the upper layers you find more advanced technologies. For example, the Media layer contains the fundamental technologies used to support 2D and 3D drawing, audio, and video.
iOS Technology Layers

- Core OS:
  - OSX Kernel
  - Mach 3.0
  - BSD Sockets
  - POSIX Threads
  - Security
  - Power Management
  - Keychain Access
  - Certificates
  - File System
  - Bonjour and DNS Services
iOS Technology Layers

- Core Services:
  - Collections
  - Address Book
  - Networking
  - File Access
  - SQLite
  - Core Location
  - Net Services
  - Threading
  - Preferences
  - URL Utilities
iOS Technology Layers

- Media:
  - Core Audio
  - OpenAL
  - Audio Mixing
  - Audio Recording
  - Video Playback

- Media Formats:
  - JPEG, PNG, TIFF
  - PDF
  - Quartz 2D
  - Core Animation
  - OpenGL ES
iOS Technology Layers

- **Cocoa Touch:**
  - Multi-Touch
  - Core Motion
  - View Hierarchy
  - Localization
  - Controls
- **Alerts:**
  - Web View
  - Map Kit
  - Image Picker
- **Camera**
Practical Advice

- The starting point for any new project is the Cocoa Touch layer, and the UIKit framework in particular.
- When deciding what additional technologies to use, you should start with frameworks in the higher-level layers.
- The higher-level frameworks make it easy to support standard system behaviors with the least amount of effort on your part.
- You should fall back to the lower-level frameworks only if you want to implement custom behavior that is not provided at a higher level.
Next Time

- MVC Design Concept
- Introduction to Swift