Work in Progress: Synthesizing Design, Engineering, and Entrepreneurship Through a Mobile Application Development Course

Mark L. Chang

Franklin W. Olin College of Engineering, mark.chang@olin.edu

Abstract – **In this paper, we describe our experiences in designing and delivering a course that blends together design, engineering, and entrepreneurship through the use of mobile devices. The significance of this work is in advocating for and demonstrating the motivational and educational benefits of using a mobile platform, and describing how to utilize the mobile marketplace to provide an authentic, real-world experience across these three domains.**

Index Terms – Android, design, entrepreneurship, mobile, software engineering.

DESIGN AND ENTREPRENEURSHIP CURRICULUM AT OLIN COLLEGE

The Olin College curriculum strives to integrate new modes of thinking into the traditional engineering foundation. We consider user-centered design principles and entrepreneurial thinking of equal importance to technically rigorous engineering and a broad set of experiences in arts, humanities, and the social sciences. Currently, a four-year design stream is embedded in the curriculum, and entrepreneurship courses are required of every student.

While specific coursework in these domains has strong value in developing foundational expertise, without cross cutting courses that synthesize these principles, we will miss unique educational opportunities. We believe that in the electrical and computer engineering and computer science disciplines, the modern mobile device has matured into a platform that provides rich experiences in these three areas.

MOBILE APPLICATION DEVELOPMENT

To leverage the growing student interest in smart phones such as Apple's iPhone and Google's Android, we created a course, *Mobile Application Development* [1], in the Spring of 2009. The objective of the course is to investigate the mobile landscape through the lenses of design, entrepreneurship, and engineering. We draw inspiration for this course from Hal Abelson's *Building Mobile Applications* at MIT [2], Stanford's *CS 193P: iPhone Application Programming* [3], and Maneesh Agrawala's *CS160: Introduction to Human Computer Interaction* at Berkeley [4].

The course leverages required coursework at Olin in software design, user-oriented design, and business and entrepreneurship, and applies these concepts in a mobile context. Technically, students learn about all aspects of the Google Android platform and SDK. Through design, students engage in ideation, user study, and lightweight rapid prototyping. To experience entrepreneurship, students unpack the mobile market space to find points of opportunity. In the final project for the course, students work in teams to develop commercially viable Android applications and release them to the public through the Google Android Market.

A significant component of the course is interacting with representatives from all facets of the mobile industry. We are fortunate to be in an area where there is a lot of mobile business activity, and have been successful in attracting CEOs, expert designers, marketing professionals, and other mobile industry leaders. These guest lectures provide the students with detailed, real-world insight into the inner workings of devices, markets, and applications that their generation has found indispensible for work and recreation.

PRELIMINARY FINDINGS

I. The mobile market ecosystem provides the lowest barrier to a real, interdisciplinary world of design, engineering, and entrepreneurship

Advances in three key areas have made the current generation of "smartphones"—such as the Apple iPhone, Google's Android, and the Palm Pre—a uniquely-positioned platform for educators to adopt for interdisciplinary coursework. First, the hardware has matured to include multitasking operating systems with gigabytes of storage and ubiquitous high-speed connectivity to the Internet. Second, developer support in the form of first-class language support, powerful and mature development environments, and vendor support of developers independent of the cellular carrier, provides developers the tools to create compelling user experiences. And third, successful direct-to-consumer distribution channels, providing turnkey application publishing and sales to any developer, such as the Apple App Store, Google's Android Market, and others.

The barrier to entry into this unique intersection of disciplines can be as low as $25USD, the cost to create a distribution account with Google's Android Market.

II. Successfully leveraging the mobile market requires students to cross discipline boundaries

The interdisciplinary educational impact from these three advances is profound. First, the hardware allows for novel, connected, computationally expensive, and beautifully rendered applications that allow good design principles to be expressed and realized. Second, the development environment is simple, with clean abstractions and a wealth of libraries to build upon—students can build applications quickly without straying too far from their foundational computer science knowledge. Third, the distribution channel allows student's work products to escape into a thriving marketplace effortlessly, providing an opportunity to put market analysis, advertising, and revenue model concepts to the test.

The Apple App Store model of the on-device application marketplace is, by all accounts, a runaway success. With over 140,000 applications available, however, success is not guaranteed. With so many resources from industry being devoted to these marketplaces, students must truly embrace all facets of developing for customers to be successful. This includes identifying **business** opportunities in the mobile space, providing novelty and utility through **design** and **entrepreneurship**, delivering functionality and stability through good **engineering**, and successfully promoting and marketing the product or service as an **entrepreneur**.

III. One cannot underestimate the allure of working with a modern smartphone

Both semesters that the course has been offered, student interest has been very strong. Our engineering students, by and large, are excited by the opportunity to work with cutting edge technologies. Advanced mobile phones such as the iPhone or an Android device represent the leading edge of alluring techno-gadgetry. These devices present a unique intersection of desirable devices that can be programmed. Loaning students devices and giving them the power to control their devices has received overwhelmingly positive feedback from students. But perhaps the greatest attraction to the course is the opportunity to participate in the incredibly trendy and seemingly lucrative mobile application marketplace. Student desire to see their applications being downloaded onto devices is positively amazing.

Taking all of these motivators together, student commitment to the course is astounding. While the initial Android SDK learning curve may be a bit steep for many, students are remarkably eager to learn new features of the SDK and tackle increasingly complex assignments. Anecdotally, students are driven by a simple desire to produce something successful that might be used by millions of users. What is unique about a modern mobile platform is that they are acutely aware that it is within their grasp.

IV. Blending design, engineering, and entrepreneurship in an authentic way presents a staffing challenge, or an opportunity for team teaching

While we have argued that the modern mobile platform gives students the opportunity to blend these three disciplines together, it is not a simple task to be the instructor in this context. Rarely does one individual possess significant expertise in all three areas. While this may be viewed as a pitfall, it should be considered yet another opportunity, this time, for team teaching.

Alternatively, importing these skills through guest speakers from academia and industry provides an authentic voice in class. Finally, enforcing stronger prerequisites may be a necessary fallback to ensure adequately prepared students when staffing presents as a barrier.

V. The end goal of market release is a rare opportunity for closure and feedback

In our course, a requirement is to release the final application to the public through the Google Android Market. This presents several key educational opportunities:

- Student motivation is significantly higher when their work "goes public". With millions of handsets sold, the "public" is very large and motivating.
- Students desire to learn good software engineering principles, such as revision management, testing methodologies, and bug tracking.
- There is a unique opportunity for feedback on both the engineering quality and the design decisions. Rarely do students get feedback of this magnitude and reality on the decisions they make in open-ended projects.

We have described our mobile application development course design and some preliminary results from two iterations. We are actively developing the course with industry partners and widening the internal staffing to bring a broader set of expertise to bear. We hope to expand the course to encompass more student-centered technologies. Our next iteration will likely mix mobile and web applications using the same framework.

REFERENCES

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AUTHOR INFORMATION

Mark L. Chang, Assistant Professor of Electrical and Computer Engineering, Franklin W. Olin College of Engineering, mark.chang@olin.edu.