Enriching Students’ Learning Experiences through a Mobile Lab Initiative

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Abstract—The introduction of courses in mobile computing in the offering of the Seidenberg School of Computer Science and Information System is one of the components of a broader initiative of aligning the curriculum with the computing industry trends and supporting interdisciplinary programs. The first course on mobile computing entitled “Mobile Application Development and Entrepreneurship” was offered in the summer 2008 and since then, a series of new courses has been proposed. The Pace Seidenberg Mobile Lab was created in spring 2010 and has brought together a group of passionate students to design and develop mobile solutions using a wide range of technologies, and perform research in and contribute to mobile computing. This paper presents courses on mobile computing offered at Pace, the goals of the Pace Seidenberg Mobile Lab, and showcases various students’ projects. It also explores students’ perceptions of their overall learning experience in the lab and reports on the directions students would like the lab to evolve in.

Index Terms—Mobile technology, Education initiative

INTRODUCTION

At the end of 2010 the research and predictions from Morgan Stanley stated: “Forget the desktop, the future is mobile all the way”. Ilja Lairs, the head of the GetJar mobile app store, said that “mobile phone applications will be as big if not bigger than the Internet”. The device landscape is changing rapidly. Since 2008, more than 170 Android devices have been launched by different carriers adopting the Google platform. The demand of the industry and the abounding number of online stores for mobile applications are creating unprecedented opportunities for developers and entrepreneurs.

Pace University has been offering courses in mobile computing since summer 2008. The first course was entitled “Mobile Technology and Entrepreneurship”. The course evolved and a series of new courses has been offered since then in classroom and online settings and as part of academic credit and continuing education programs. The Pace Mobile Lab was created in spring 2010 to create a community around mobile computing and encourage students to develop mobile solutions to contribute to the field.

This paper is organized as follows. Section 2 presents some courses on mobile computing offered at Pace University. Section 3 presents the Pace Mobile Lab and some similar initiatives in the US and other countries. Section 4 showcases mobile solutions designed by students. Section 5 presents the future directions of the lab.

COURSES AT PACE

In the course “Mobile Technology and Entrepreneurship”, students with previous experience in Java and software engineering were introduced to the basics of mobile phone application development with Java ME. Additional topics included a presentation of the mobile landscape (devices, operating systems, development environments), a survey of existing mobile applications for various platforms, and the entrepreneurial opportunities of the global mobile industry. The just-in-time technical knowledge acquired in the course was applied in the design and implementation of an innovative mobile application for a real client located in Africa (Senegal) using Scrum. A certified Scrum master of the industry was involved and the course also looked at the appropriateness of Scrum in mobile development projects [1].

The course evolved to be more of a survey course on mobile computing emphasizing entrepreneurial opportunities. In fall 2010, students were introduced to smart phone development for Blackberry and Android phones. They also got familiar with SMS technology that is very popular in marketing and experimented with SMS gateway software such as FrontlineSMS (http://frontlinesms.org) and Kannel (http://www.kannel.org). The course also accommodated talks from external speakers of the industry. One of the contributors to the Ushahidi crowdsourcing system (http://ushahidi.com), Oscar Salazar, presented how he deployed and used Ushahidi to monitor the federal elections in Mexico (http://cuidemoselvoto.org). The course integrated a project where students developed a mobile solution (mobile application or SMS service) to improve life on campus. Some of the solutions developed in fall 2010 are presented in this paper.

Other courses on mobile computing offered at Pace include an online course on Android development. The Pace Computer Learning Center is offering courses on Android,
Blackberry and iPhone application development (http://appsrv.pace.edu/pcl).

Another way to introduce mobile computing in the curriculum is to integrate modules in courses. Mobile computing was introduced in the undergraduate capstone course. Since 2005 we have been running an annual global software development (GSD) project that investigates different models for students distributed across three to four countries to develop software together. The objective is to prepare students to gain key technical and non-technical competencies and skills for the global labor market by simulating scenarios and integrating state-of-the-art practices of the industry. The software developed by the teams switched from web applications (2005-2008) to mobile applications (2009-) to permit students to have an appreciation for this promising technological field and its global impacts. In 2009 a team of students distributed across the US, India and Senegal developed a Java ME application called TargetFirstGrade that first-grade pupils can use to practice mathematics, reading, writing and geography, supervised by teachers or on their own [2]. Target First Grade was to be used in large classes in developing countries. In spring 2011 a student of the Pace Mobile Lab improved TargetFirstGrade to make it deployable in Senegal in summer 2011. In the GSD 2010 Students in the US acted as developers and students in India, Cambodia and Senegal played the roles of testers [3]. Pace students developed mobile applications to improve life on campus for Android, Blackberry and Java ME phones. The applications were respectively flash card, note taking and accounting applications.

PACE MOBILE LAB

Mobile technology has been evolving rapidly and students in Computer Science and related disciplines are developing or very interested in developing mobile solutions. School-based labs have been created to strengthen initiatives in the mobile technology field. In institutions across the US and abroad, mobile labs are focusing on different interdisciplinary topics such as mobile marketing and commerce [4], entrepreneurship [5], global challenges [6,7], and gaming [8]. The Pace Mobile Lab will focus on research topics related to voice, mobile marketing, and mobile for the next billions users, i.e., people of developing countries, 70% of the mobile subscribers and users.

The Pace Mobile Lab was created in spring 2010 and became active in spring 2011. The main objective of the lab is to create a community around mobile computing. The lab is currently funded by a Pace Thinkfinity grant. Google and RIM provided the lab with developer Android and Blackberry phones and Microsoft arranged for a loan of Windows Phone 7 phones. Sony Ericsson and Nokia feature and smart phones are available in the lab to test mobile applications. The lab has servers running the FrontlineSMS and Kannel SMS gateways, and the Prophecy voice server (http://voxeo.com). Many mobile applications and solutions have already been developed by students as term projects in different courses. We hope that students will use lab resources to implement mobile solutions they are passionate about and polish their applications and make them reach a professional level to be distributed in app stores.

Building up on skills they acquired in the fall 2010 course, a group of passionate students gathered to design and develop mobile solutions using a wide range of technologies, perform research in mobile computing, and contribute to mobile computing. Some of the solutions they designed are presented in section 3. The technologies used include FrontlineSMS and Kannel for SMS services, Prophecy for voice solutions, and Android, Blackberry, Java ME and Windows Phone 7 for application development.

The lab meets weekly for students to report on their progress and make presentations. At this meeting, students share interesting mobile solutions they discovered during the week (e.g., iButterfly and shopkick) to keep in touch with the latest advancements of the field. Students’ presentations are also organized for the larger Seidenberg community to generate interest and encourage students to join the effort (e.g., for the students of the Pace Computer Society). The lab organizes an annual contest that permits students to compete against each other’s in a friendly environment, win great prizes, and get ready to participate to external contests.

The latest information about the Pace Mobile Lab is available at: http://facebook.com/pacemobilelab.

SHOWCASING MOBILE SOLUTIONS DEVELOPED BY STUDENTS

In this section we present mobile solutions developed by students in fall 2010 and spring 2011.

3.1 TargetFirstGrade [Alex Mitchel, Serene Su, Ahmed Tidjane Cisse, Gilchrist Ouedraougo, Nancy Gupta, Ritu Bansal]

TargetFirstGrade is an educational mobile application for children in first grade. This application, developed in Java ME, is intended to enable children to answer questions from four topics: mathematics, geography, writing, and reading, and get immediate feedback on whether their answers are correct or not. The goal is for TargetFirstGrade to be used on feature phones by children of large classes in developing countries to practice with topics introduced by the teachers. First grade pupils should enjoy the possibility to exercise their skills, test themselves at their pace, and increase their mathematics, geography, reading and writing skills and knowledge in geography. Parents have the possibility to get feedback on their children performance via SMS. The development of this application started in fall 2009 as part of the global software development project [2]. Five students from the US (1), India (2) and Senegal (2) experienced working in a distributed...
context and the difficulties of coordination across time zones, culture and distance. They implemented part of the user stories of TargetFirstGrade. They followed the Scrum management framework. GSD 2009 got some press [9] and everybody was asking: “What happened to TargetFirstGrade?”. In spring 2011 a student with previous experience in developing Java ME applications is improving and finalizing the application. The plan is to deploy and pilot TargetFirstGrade (French version) in Senegal in the summer 2011. The logic of TargetFirstGrade has been improved and bugs have been fixed. The content of the applications has been extended such that several questions are randomly chosen in each topic. Each answer can now be evaluated and scored, and the total score is calculated and provided for each topic. Developing this application has been a beneficial experience for the developers involved in the project. In addition to getting experience in mobile application development, the developers gained experience in using the Model View Controller pattern (MVC) and object-oriented programming concepts.

FIGURE I. TARGETFIRSTGRADE

3.2 Pace Fun Places [Kelly Sottlemeyer]

Crowdmap (http://crowdmap.com) is the (free) cloud version of Ushahidi (http://ushahidi.com), a platform that was originally built to crowdsource crisis information. Ushahidi is called the “African gift to the Sillicon Valley”. Developed originally during the 2007 Kenyan presidential election, it has since been used after the earthquake in Haiti in 2010, during the federal elections in Mexico in 2009 and to monitor crimes in Atlanta in 2010-2011. Ushahidi is an open source platform that permits to collect, map and visualize data that is submitted via the web, SMS, twitter and email. Crowdmap allows anyone to set up a deployment of Ushahidi in the cloud, thus server and installations are not necessary and only minimal setup is needed.

Crowdmap has been deployed to permit Pace University students of the New York City campus to submit the places they considered entertaining in New York City and its surroundings. The Pace Fun Places deployment (http://pacefun.crowdmap.com) will prove to be an innovative new way for Pace University students to connect with one another and discover new places and activities in New York City. The website shows an embedded Google map centered on the Pace campus in New York City. Students can submit different types of places they enjoy. There is a legend to indicate different categories: Bar, Beauty, Entertainment (sport and art), Restaurants, Shopping, and Hot Spots (other). Pace Fun Places is a way for students to have fun, share their favorite places, and learn about other students’ favorite places. There are a number of intangible benefits of this system including the creation of a more community like student body, students reaching out to their fellow students with common interests, and students becoming more immersed and involved in the city they live in, New York City. Other social media sites like Facebook and Yelp! provide similar solutions but not specific to Pace University students. Because Pace Fun Places is run on Crowdmap, it can be customized to meet future trends. From the submissions we noticed that a majority of students concentrated on the Entertainment and Restaurant categories ranging from locations in Manhattan, to Bronx and Queens.

FIGURE II. PACE FUN PLACE

3.3 StopByPace [Palak Shah]

Pace University is a multi-campus university. Not all students entering Pace University know about the addresses, locations, and directions to the different campuses. This information is provided on the Pace website but not easy and quick to find. Phones have geolocation capability that can be used to get information about locations and directions (driving, walking, cycling and public transportation directions). Locations can be determined directly using GPS or by triangulation using the WiFi. StopByPace is an Android
application that can immediately track the location of the user and indicate the directions to specific Pace campuses. StopByPace uses Google maps. The different campuses can be displayed on a single map with their addresses. StopByPace also provides pictures of the different campuses. It was developed using Eclipse and the Android plug-in. It requires Android 1.6 and the minimum SDK version for this application is 4.

FIGURE III. STOPBYPACE

3.4. Mobile Marketing for the Pace Radio [Billy Gerhard]

Mobile marketing refers to the use of mobile devices to communicate and engage with the audience in an interactive way. It provides potential customers with personalized information based on time and location. Mobile marketing uses technologies including SMS (via short codes), QR codes, mobile web sites, Bluetooth, and mobile applications. Pace University has an Internet radio station, WPUB (http://www.wpub.com), located on the New York Campus.

Very few students know about the existence of the station. We started a mobile marketing campaign to raise awareness and create buzz, generate a database of listeners, drive traffic to the web site, and increase and engage the audience. The campaign began by asking people to send an SMS with a specific keyword to a phone number to register to get regular alerts about events. Users could opt out at any time by sending STOP to the same number. DJs announced the campaign on the air and the marketing team posted messages on Facebook, Twitter, posters and web sites. The keywords will permit the station to determine the most effective channel to reach the listeners and the people interested in the station. The marketing team sent alerts by SMS. To engage listeners it organized SMS contests where listeners could win prizes. The station team is provided with analytics containing the number of listeners and how they can be better reached (e.g., DJs, twitter, facebook, web site, and posters), how many announcements were sent, and how many people participated in the contests. The SMS solution is implemented using the free FrontlineSMS gateway. This choice was considered for sustainability. FrontlineSMS does not require technical knowledge for group management and basic SMS administration. However, sophisticated SMS management requires technical knowledge in a scripting language (e.g., PHP). A complete manual will be provided to the station and training will be organized to permit it to manage SMS campaigns on its own after fall 2011. We are in the process of evaluating this campaign at the time this paper is written.

3.5. MobileSenegal [Allon Hadaya]

Over the last three years Dr. Scharff and collaborators in Senegal have been leading a project called MobileSenegal (http://www.mobilosenegal.org) that promotes educational initiatives linked with mobile computing in Senegal [10]. The project has been funded by NCIIA, Google, and IBM. Since 2009 five bootcamps, four courses, two trainings for faculty and two mobile development competitions have been facilitated and organized in Senegal. As part of the project several mobile applications were deployed for a large number of users including KomKom, an accounting application for artisans, and WanniGame, a game on numbers for children. KomKom was awarded a judge prize at the Nokia Calling All Innovators competition in 2009. As part of the project, SOSStudent (campus information for new students), MyWallet (accounting) and TimeManagement were deployed on the phones of more than 50 students at the University of Thies (70 km from the capital city, Dakar).

To provide visibility to the project, a mobile application has been developed. The application shows 100 pictures about the power of mobile phones for social change in Senegal and how people are using mobile phones. The pictures were collected from photo contests organized for students in Senegal. The users of the MobileSenegal application can favorite pictures and share them via facebook, twitter, SMS and email. Details and a map of Senegal are provided for users to know more about the country. The application is currently available on Window Phone 7 and will be released in the App Hub in the next weeks.

FIGURE IV. MOBILESENEGAL

FIGURE V. MOBILESENEGAL
FUTURE DIRECTIONS AND INITIATIVES OF THE LAB

An online questionnaire was administered to the students of the lab to explore their perception of the lab and interest in mobile computing. The feedback of the students is important to determine the future directions and initiatives of the lab. The results we collected are presented below in the form of question / answer.

- “What do students like the most about the lab?” Students like “learning new technology in the exciting mobile technology world”. Students appreciate the “weekly meeting where [they] can update and Q&A each other’s projects” thus “making the lab an interactive place where discussions are helping [them] a lot”. The lab is “a warm environment leading to great knowledge about mobiles and application development”. Some students like “the combination of the academic and professional discussions”. In the words of a student, the lab is simply “a techie family having fun”!
- “What did students suggest to improve the activities of the lab?” Students suggest “inviting different industry speakers to share their experience”.
- “What activities should the Mobile Lab organize?” Students mentioned that the lab should organize internal contests, technical contests, inter-school contests, and speaker series (in that order).
- “How do students see their experience in learning mobile technology as part of the lab?” All students considered their experience in the lab positive. They liked working on “real projects” (“real applications” for “real clients”). Some of the students found the lab as a strategic place to do “research and learn about cutting-edge technologies and ideas”. They could also gain experience and “become proficient in a [mobile] platform using learning by doing”.
- “How do students evaluate their contribution to the lab?” Only half of the students said they made “over the average” contributions to the lab. Some others were candid and admitted that they “should have done better”. They mentioned time as their main challenge. One student stated clearly that he wishes to “stay with Mobile Lab after this semester even though [he] will graduate”.
- “What difficulties did students meet?” Almost all students stated that they met “technical difficulties”, especially at the beginning of their projects. They considered that there is a learning curve to become proficient in mobile application development. They were challenged by their projects but appreciated the difficulty. One student stated that “if there is no difficulty at all, there is no value!”

The Pace Mobile Lab will evolve based on the research trends, demand of the industry and interest of the students. In fall 2011 it will propose technical sessions on Android and mobile web application development to prepare the organization of a new mobile contest. Guest speakers will be invited to talk on themes such as mobile money and mobile health. The research topics of the lab based on voice, mobile marketing and mobile for social changes will be refined to be decomposed in specific projects to be tackled by students.

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REFERENCES