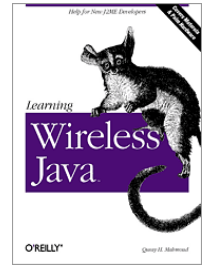


Integrating BlackBerry Wireless Devices into Computer Programming and Literacy Courses

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Abstract

As cellular phones, personal digital assistants, and other handheld wireless devices become more pervasive than traditional personal computers, there needs to be academic innovations in the areas of computer literacy and programming models. We have integrated BlackBerry devices into computer literacy and introductory programming courses. The courses are lab-intensive where students experiment with the devices, and develop and deploy simple applications on them. Teaching computer programming in the context of simple wireless mobile applications provides a motivating framework for students, inspires them, and raises their level of excitement and satisfaction.

Introduction

The BlackBerry device is a general purpose communicating device that presents a great deal of opportunities for educators in computer science as well as other fields to be integrated in the curriculum. Students in introductory programming courses usually develop and test their applications or programming assignments on a platform similar to the one on which it will be tested by the instructor or teaching assistant. But this is not the case for wireless mobile applications which are developed on one platform (such as Microsoft Windows) and deployed and run on a totally different platform (such as a cellular phone or PDA). Thus, there exists an opportunity to introduce students to different programming models, but more importantly we believe such experience will be as practical as possible since it will inspire students to be excited about learning as it will enable them to eventually program their own Java-enabled wireless devices.

Goals

- Introduce computing and non-computing students to the BlackBerry wireless device
- Investigate how to integrate handheld wireless devices into the CS curriculum
- Provide students with a motivating framework that inspires them and raises their level of excitement and satisfaction
- Teach students about programming models for developing applications for wireless devices
- Revitalize CS education by integrating bleeding-edge technology in the classroom
- Investigate how m-learning can be used at the University of Guelph and the University of Guelph-Humber

Java ME and BlackBerry Devices

- The Java Platform, Micro Edition (Java ME) provides a complete set of solutions for creating networked applications for consumer and embedded devices
- We used the Connected Limited Device Configuration (CLDC) and the Mobile Information Device Profile (MIDP)
- Many BlackBerry devices support Java ME (we used the BlackBerry 6280 model)

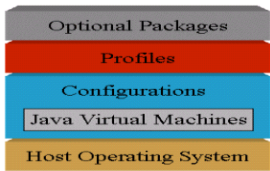


Figure 1: High-level architecture of Java ME



Figure 2: BlackBerry 6280

Computer Literacy Courses

- Over the past 15 – 20 years, the basic applications for computer literacy courses have been word processing, spreadsheets, presentation software, and database management on desktop PCs
- Recently, these courses include the Internet and Web development
- Most student activities focus on the social side of computing: instant messaging, e-mail, music, video, and games
- There needs to be innovation in the area of computer literacy
- The University of Guelph has successfully introduced BlackBerry devices into "Introduction to Computing"
- Students use the BlackBerry devices, which address many of their current social uses
- Permits students to decide for themselves if it is a tool in their future
- In the labs, students experiment with the device and its applications, such as email and Web access, and use it to manage electronic information
- For most students, this was their first hands-on exposure to the BlackBerry and their response was very positive. Sample lab: <http://cis1200.cis.uoguelph.ca/blackberry.htm>

Programming Courses

- **Computer Programming I**
 - First course that aims to provide step-by-step approach to programming
 - **Programming for fun:** integrates HTML, JavaScript, and Java in a single course
 - Use pair programming in labs and assignments
 - Integrated the BlackBerry: two weeks of lectures and 6-hours of labs
 - Students learn about Java ME and the programming model for handheld wireless devices
 - Students learn how to write simple applications and deploy them on physical devices
- **User-Centered Programming**
 - A third semester course
 - A technically-intensive introduction to GUI programming using Java AWT/Swing
 - The objective, along with a course on Data-Centered Programming, is to produce software developers capable of designing and developing interactive client-server applications
 - Using the BlackBerry: three works of lectures and 9-hours of labs
 - Students learn about Java ME and the programming model for handheld wireless devices
 - Students learn how to write networked wireless applications that interact with remote services

Programming Models and Application Deployment

- **Programming models**
 - The BlackBerry device supports two models; browser-based using markup languages, and custom Java applications. We focused on Java-based applications
- **Application Development and Deployment**
 - Students usually build, test, and evaluate an application on a platform similar to the one on which it will be deployed and run
 - Wireless applications are developed on one platform and deployed on a totally different platform
 - While simulators and emulators to do some of the testing on the development platform, ultimately applications must be tested on a physical device in a live wireless environment
- **Software Tools and Devices**
 - Sun Java Wireless Toolkit 2.5 for CLDC (<http://java.sun.com/products/sjwtoolkit>)
 - BlackBerry Simulator (<http://www.blackberry.com/developers/downloads>)
 - BlackBerry Java Development Environment (JDE)

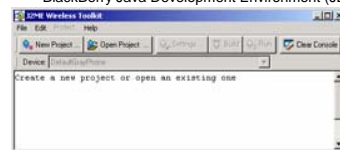


Figure 3: Java Wireless Toolkit



Figure 4: BlackBerry Simulator

Labs, Assignments, Projects

- In the labs, students learn how to:
 - Run existing wireless applications (e.g. a MIDlet interacts with Yahoo finance server)
 - Use tools to convert existing MIDlets (.jad & .jar) into .cod format for the BlackBerry
 - Deploy applications on physical BlackBerry devices
 - Write simple applications (first year) and networked applications (second year)
 - Test applications using the simulation and emulation environments
 - Package applications for deployment on physical devices
- Assignments
 - First year: students developed two versions of a mortgage calculator (desktop and BlackBerry). Students learn that the application logic doesn't change.



Figure 5: Mortgage calculator

- Second year: (1) Apply the Model-View-Controller (MVC) design pattern to design and develop a multiple choice quiz that will be marked on the fly, and (2) an application to retrieve students' marks from a remote Web service by interacting with a Perl script

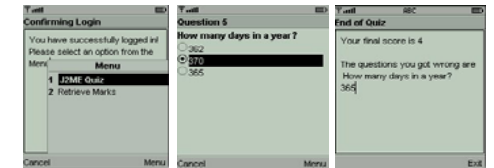


Figure 6: Multiple-choice quiz

- A Second Year Project
 - A group project (5-6 students per group)
 - A system for linking doctors & pharmacists to manage patients data and prescriptions
 - A shared project with the Data-Centered Programming course



Figure 7: The doctor's view of the medical application

References

- Mahmoud, Q.H., Dobosiewicz, W., Swayne, D.: *Redesigning Introductory Computer Programming with HTML, JavaScript, and Java*. In Proc. Of 35th ACM Technical Symposium on Computer Science Education (SIGCSE), Norfolk, VA, USA, March 2003, pp. 120-124.
- Nagappan, N., Williams, L., Ferzli, M., Wiebe, E., Yang, K., Miller, C., and Balik, S.: *Improving the CS1 Experience with Pair Programming*. In Proc. of 34th ACM Technical Symposium on Computer Science Education, Reno, NV, USA, March 2003, pp. 359-263.
- Wagner, E.D.: *Enabling Mobile Learning*, Educause Review, Vol. 40, No. 3, May/June 2005, pp. 40-53.

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