

CREU Research Proposal
Tablet-Based Grading Tool Development and Analysis

Academic Advisor
Prof. Jeffrey Popyack

Student Participants
Shivani Saini
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1. Project Title

Tablet-Based Grading Tool Development and Analysis

2. Participants

Olga Zalan

Shivani Saini

Professor Jeffrey Popyack

3. General Project Description

For our project, we would like to research methods for improving grading efficiency for electronically submitted assignments and providing more valuable feedback to the students. We would be working on making the assignment markup process similar to the hand grading method while utilizing the "pen-based" interface provided by the Tablet PC.

With a high number of professors utilizing the latest technology e.g. online course management systems and electronic assignment submission, the traditional methods of assignment markup using a pen and a paper are becoming a thing of the past. Even though the online submission process allows the faculty members and graders to manage assignments in a much more organized way, it does have a few disadvantages. For instance, with the current assignment submission process, the need for paper submission has been eliminated; graders, who were accustomed to marking up students' assignments with comments, corrections and suggestions right on a paper document that the students submitted, are now left to decide on a method that would provide the best feedback to the students and we have noticed that every grader does it in a slightly different manner.

With introductory computer science course, we have observed that the graders end up summarizing their comments on a grade sheet of some sort and often times the students are not able to comprehend what the grader is referring to because the comments are not shown in context to the source of their mistake. Also, getting accustomed to different grading styles for different graders takes some time as opposed to the old way of assignment markups where most people did it in a similar fashion. Not understanding the grader's feedback also makes it harder for students to learn from their mistakes. Another thing we have observed is that the students do not look over their work once they receive their grade sheets because they find it very inconvenient and time consuming to match up the comments to the mistakes on their assignments, which are often times returned after a week or so after a submission. Also these comments are not very detailed and thus provide minimal value to the students.

With electronic submissions, a few graders have tried other approaches to make the grading process easier, more efficient and satisfactory for the students. Some have tried printing out a copy of the students' submissions and making remarks on their printouts [Popyack2]. In our opinion, this process is not at all efficient to be used for a large group of students. Keeping track of students' grade also becomes tedious when graders try to use these alternative methods.

One relative new technology that some of the professors have already started utilizing in their courses is the use of the Tablet PC. Faculty are using Tablets to present notes during lectures, draw diagrams, write mathematical equations, as well as for other purposes such as electronic submission of lab reports. Tablet PC, unlike a regular PC, provides a pen-like interface that allows users to write on a tablet more like they would write on a piece of paper. This feature of the Tablet PC is quite appealing for grading electronic documents that are becoming very popular these days with numerous courses. Tablet based grading is similar to the “paper-based” system but is more efficient since it saves time (because the grader doesn't have to print-out the work), allows for easy grade tracking and prevents mishaps (such as lost assignments). It also gives students a much valuable feedback, which in turn helps them better evaluate their performance in a course.

With a high demand of software for grading electronically submitted documents and a rich and easy to use Microsoft Tablet PC Software Development Kit [SDK], we believe we can create an interface that will allow graders to markup documents like they would do using the traditional grading methods. To achieve this goal, we will utilize Tablet's PC's Ink data type combined with a well developed user interface that will allow graders to open all the student's submissions in one place, convert them into a Tablet friendly format (OneNote, PDF, Word etc), open them next to a grade sheet where the graders can enter grades as they markup the assignments and then update grades to a central grade database or an excel document We will examine already developed software for grading assignments such as the one developed by Project DUPLEX [Duplex] and Blaise, “a paperless submission and grading system for writing courses” [Simha]. We will use these as references in developing a solution that will be valuable to the graders as well as the students. We will involve graders and students in the project from the start and will use their feedback to improve and build software that they would prefer over current grading methods.

4. Specific Questions/Hypotheses (to be addressed)

How can a Tablet PC be used to better help professors and teaching assistants grade assignments and provide feedback to the students?

What are the current techniques being used by most graders and how can these be automated?

What feature of Tablet-based grading software will enhance its desirability for graders (for ease of use) and students (for perceived quality of feedback)?

What are the bottlenecks in the current software that has been developed for grading programming assignments and how can they be eliminated in the software we design?

How can we achieve speedup while grading so that we make sure the graders uses this method of grading compared to the traditional methods?

5. Methods

Methods used to conduct the research will include:

1. Requirement Analysis and Background Research

Understand the grading techniques and needs of teachers and teaching assistants and get acquainted with Microsoft Table PC Software Development Kit, which will be heavily utilized in the development stage. Study current software that has been developed for grading purposes and evaluate their shortcomings and write up a requirements document.

2. Design

After gathering all the software specifications, the students will come up with a prototype to meet the needs of the graders. Most of the implementers' work will be done in this stage to avoid problems during the implementation stage.

3. Implementation

During this stage Olga and Shivani will be heavily involved in coding using Microsoft Tablet PC Software Development kit which helps develop ink-enabled applications easily. Students will be integrating Adobe Acrobat software as well as Microsoft word into their grading software; MS Word as well as Adobe Reader have built in markup capabilities that will allow the end user to hand write comments right there on a student's assignments, which will in turn allow the students to better analyze the feedback since they'll be able to see the grader's comments in relation to their context/location on the paper. Students will be using C# as their primary language for this project.

4. Testing and Analysis

Have the teaching assistants, professors and students test the grading software during monthly test sessions to see if it meets their needs. Gather feedback and analyze if more work is required. Keep meeting logs to assess progress. Implement the comments and suggestions into the solution if possible and improve the design. Conduct a student satisfaction survey through standard course evaluations, interviews with students, and posting on course discussion board. Also, conduct a control group study where some of the students will be graded using traditional methods whereas others will be graded using the software developed. Analyze and study differences in ease of grading, time consumption, and student satisfaction through this study. Also, at the end of a term, gather a focus group of students and graders to access issues and concerns in our implementation.

6. References

- [Duplex] Project Duplex, <http://duplex.cs.drexel.edu/about.htm>.
- [InfiNotes] Agilix InfiNotes, <http://www.agilix.com/infinotes.aspx> .
- [Jarrett] Jarrett, R., Su, P., Building Tablet PC Applications, Microsoft Press 2003, ISBN: 0-7356-1723-6.

- [Popyack] Popyack J, Herrmann N. Pen-Based Electronic Grading of Online Student Submissions. Syllabus, 18-20, January 2003. [Also at <http://www.campus-technology.com/article.asp?id=7094>].
- [Popyack2] Jeffrey L. Popyack, Nira Herrmann, Bruce Char, Paul Zoski, Chris Cera, Robert Lass. Pen-Based Electronic Grading of Online Student Submissions. http://duplex.cs.drexel.edu/docs/Syllabus_Drexel_Handout.pdf
- [SDK] Microsoft Windows XP Tablet PC Edition Software Development Kit, <http://msdn.microsoft.com/mobility/prodtechinfo/platforms/tabletpc/> .
- [Simha] Rahul Simha¹, Sean Hanlon, Michael Gaiman, Jared Kiraly, Eisuke Arai. Blaise – A Tablet-Based Paperless Submission and Grading System for Writing Courses. <http://www.blaise.gwu.edu/pubs/BlaisePaper.pdf>
- [Tablet] Tablet PC website, <http://www.tabletpc.com>
- [TabletDev] Mobile PC and Tablet PC Developer Center website, <http://www.tabletpcdeveloper.com> .

7. Impact on the goal of CREU

The goal of CREU is to encourage students (especially women and minorities) to continue their interest in Computer Science and its disciplines and further pursue their education in the same field and continue onto Graduate school. The students, if given the opportunity to conduct this research, will gain their first ever long term research experience in a field related to their major. Both the students have taken classes and completed internships in the field, but have yet to utilize their skills in research. In addition, both the students are extremely interested in software development and this research opportunity will help them attain first hand experience in developing something as well as applying skills that they have learned in and out of the classroom. With this experience, the students will be better prepared for their future at a graduate school and will possibly engage in other research opportunities in their careers.

8. Student Activity and Responsibility

The students will be involved in identifying and studying an area of need, developing algorithms and software to address the need, assessing the effectiveness of the solution, testing/re-testing/modifying, re-evaluating the software and publishing results. Both the students will be required to document a few hours of work each week on the project website. We will be communicating and sharing thoughts and ideas via a discussion board which will be hosted on the project website. Students will meet with Prof. Popyack each week to discuss project progress and obstacles if any.

9. Faculty Activity and Responsibility

Prof Popyack has been involved in Tablet PC software development for quite some time; he will be assisting students' from the very beginning to make sure both the students understand the Tablet SDK well and are comfortable using it.

Prof. Popyack also teaches the freshmen computer science courses and will be supervising the teaching assistants' and graders' use of the software developed. This will help the students' better analyze their work and develop a better solution. Prof. Popyack will also be involved in weekly meetings with the students to measure project progress and goals.

10. Timeline

Below is a rough timeline that we plan to follow during our research:

<p>Summer 2006</p> <ul style="list-style-type: none"> • Get acquainted with the latest Microsoft Tablet PC Software Development Kit • Work with current teaching assistants to study their grading techniques and patterns to identify their needs
<p>Fall and Winter 2006</p> <ul style="list-style-type: none"> • Develop prototypes to fulfill these needs • Involve the teaching assistants as well as the students in the continuous development and evaluation of the software • Assess the effectiveness of the solution • Re-design and modify based on the evaluation response
<p>Spring 2007</p> <ul style="list-style-type: none"> • Finish implementation • Conduct a final user study • Publish results and write report on the research experience

11. Budget

Stipends:

Shivani Saini	\$3000
Olga Zalan	\$3000

Additional:

Poster Presentation at regional conferences of the Consortium for Computing Sciences in Colleges (CCSC)	
Travel (Airfare, hotel, etc):	\$450
Supplies:	\$50

Total \$6500

12. If the project is part of another larger, funded project, explain the connection and role of the CREU project within the larger scope.

Current Status: Project DUPLEX (Drexel University Programming Learning Experience)

"DUPLEX is funded by the National Science Foundation (DUE #0089009) and the PEW Center for Academic Transformation. The project is making fundamental changes in how computer programming courses are taught at Drexel, with the goal of enhancing and individualizing the students' experience while providing more efficient course management for faculty [Herr02, Cera02a]. The ultimate goal is to develop a methodology that can be exported to other courses, other departments, and other universities."

"Some of the project's accomplishments to date are:

Increasing the amount of hands-on, active learning in the classroom through the use of a specially-equipped labs exploiting the strengths of web-based course management systems (CMS) both to deliver content and to handle administrative aspects of course management [Popy02a]. Drexel supports WebCT institutionally, and its useful features include capability for online exercises and in-class quizzes, electronic submission of assignments, and online gradebooks."

Enhancing CMS support of online assignment grading through creation of a software package, Labrador [Cera02b], which is slated for further deployment at Drexel, with interest expressed by other campuses." [Duplex] Labrador, which works with the course management system to facilitate grading through batch retrieval of assignments and automatic decompression, and post processing for use by other systems (e.g., plagiarism detection). Labrador also performs automatic conversion of the source code to PDF, so that the grader with a pen input device is able to mark up and grade the electronic code by writing directly on the printouts in the same manner as would be done with hardcopy output. Some of our teaching assistants have used pen tablet grading in pilot courses. [Popyack]

Even though the use of WebCT and Labrador has eased the course management for faculty, it has raised a lot of new concerns. The biggest of these has been the amount of time the graders have been spending on grading assignments. "Downloading a set of assignments was time-consuming enough, but once obtained, our graders were either spending double the time previously needed to grade a computer program, or were not providing a desired level of feedback." [Popyack] This is an area of need the students will try to address during their research in hopes of making the grading process simpler and more efficient for both the students and the graders.

- **Name**
Shivani Saini
- **Email address**
ss424@drexel.edu
- **Major, year in school, and anticipated date of graduation**
Computer Science, Junior, June 2008
- **Gender**
Female
- **Optional: Minority Status**
Indian
- **List of courses taken relevant to this project**
Computer Programming I and II
Advanced Programming Tools and Techniques
Software Design
Data Structures
- **Any other information pertinent to the proposal**

Shivani has been working as a teaching assistant for the introductory programming classes for about one year. She, along with a few other teaching assistants, have been in charge of managing students in the labs as well as grading assignments and have noticed quite a few challenges provided by the current grading system.

Most teaching assistants have been using a grade sheet to provide their comments back to the students. This grade sheet is a separate document that is returned to the students once grading has been finished. Shivani, along with other graders, see this as a rather time consuming and inefficient process which provides feedback of minimal value to the students. Therefore, in students' as well as in graders' interest Shivani believes that a better grading method needs to be implemented and she believes that this can be accomplished through this research project.
- **Full college transcripts**
Electronic copy attached and a hard copy mailed with the proposal.

- **Name**
Olga Zalan
- **Email address**
oz24@drexel.edu
- **Major, year in school, and anticipated date of graduation**
Computer Science, Junior, June 2008
- **Gender**
Female
- **Optional: Minority Status**
Jewish

List of courses taken relevant to this project

Computer Programming Languages 1 & 2
Advanced Programming Techniques
Software Design
Technical Communication
Introduction to Interactive Media

Any other information pertinent to the proposal

Olga is currently working with WebCT, Drexel's online course management system used by most courses. She is involved in creating online quizzes for the students. These quizzes provide students with the opportunity to test their knowledge of the course material. Most of these quizzes are graded by the computer whereas there are a few open ended questions that are graded by the instructor or the teaching assistants and the feedback is provided once the grading is done. This feedback is crucial to students because it helps them evaluate their progress in the course and helps them better understand the material.

- **Full college transcripts***
Electronic copy attached and a hard copy mailed with the proposal.

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- **Email Address**
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- **Relevant background in this area**

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Jeffrey L. Popyack, Ph.D., Associate Professor, Associate Head for Undergraduate Studies, Computer Science.

Dr. Popyack has been deeply involved in curricular matters and responsibility for the Computer Science educational program for more than two decades. He is a lead participant in Project DUPLEX (Drexel University Programming Learning Experience), which has been investigating various aspects of delivering cost-effective, technology-enhanced instruction for large computer programming classes. He has also been the Project Investigator on three NSF-Due grants for Innovation in teaching computer programming courses. In 1999, he was awarded Drexel's undergraduate Teaching Award for Senior Faculty. He is an International Officers of Upsilon Pi Epsilon, the International Honor Society for Computing and Information Disciplines, and Academic Director of Pennsylvania Governor's School for Information Technology at Drexel University, a five-week summer residential program for talented and gifted high school students residing in Pennsylvania. He is the faculty advisor for Women in Computing Society at Drexel University

Also, for the past few years, Dr. Popyack along with another faculty member have led the PGSIT Software Development track, a 9-day project-oriented workshop in which groups of 4-5 students design and implement a software project. In 2003 and 2004, students used the Tablet SDK and C# to produce various Tablet PC applications. "Ever since the early days of the Tablet PCs, Dr. Popyack has experimented with several approaches to grading student assignments, and has found that a combination of pen markup and stick-on notes works best." He has experimented with everything from Wacom tablets, Sony Vaio to Tablet PC models including IBM and HP. [Popyack] He is the principal investigator of a Microsoft Research University Relations Tablet PC and Computing Curriculum grant, "Tablet-

Based Annotation for Grading and Peer Review in Computer Programming Classes,” funded in 2005.