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THE APORT WEB PORTAL: ADVANCED E-LEARNING FEATURES

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Abstract. Traditional teaching methods must deal today with challenges such as handling effectively a large number of students, keeping the interaction meaningful and focused on the course material, insuring student's academic integrity, etc. The paper presents a work-in-progress system that draws its approach from the way collaboration takes place in the business world, as well as from the experience gathered implementing and using two older e-learning systems. The proposed approach provides features that help make interaction and communication a first class element of the teaching process.

1. Introduction

The interaction between students and professors during regular academic activities such as lectures, seminars, and lab hours would benefit the student more if it were focused on the aspects that matter most to the student's understanding of the course material. This process is unfortunately often affected negatively by issues such as: lack of interaction means, insufficient time during the scheduled hours, checking the integrity of the students' solutions, performing class administrative work. The problem becomes more acute when the ratio between the number of teaching faculty members and the number of students is low.

The use of a computerized system to assist teaching is a widely used approach today. Extensive work has been done in this field and numerous e-learning systems exist both as research projects and as commercial products. The essence of the problems presented above is a need for solid and consistent mean of collaboration between professors and students, for both frontal and remote interaction. The collaboration requires support for presenting new

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material, for discussing the presented material, for reviewing and commenting on the requirements and solutions, and most of all for keeping the focus on the matter at hand without the need to divert attention to aspects unrelated directly to the discussion. These requirements are quite similar to what IT companies need in order to insure smooth collaboration between remote offices. The Aport system presented in this paper takes its inspiration from such business approaches and provides features that help make interaction and communication a first class element of the teaching process. Another key aspect of the proposed system is the focus on continuous improvement based on direct user feedback as well as information provided by an integrated web analytics module.

The work presented here relies on the experience gathered by implementing and using two other such portals in our department. The Aport system is meant to replace the older systems [7, 4] but it is currently only in a development stage.

2. Collaborative Features

The collaborative features are meant to assist the professor and the students in collaborating remotely, thus reducing the time wasting traveling to the meeting point while keeping the information exchange alive and meaningful.

2.1. Audio/Video Conferencing.

The most intuitive way of exchanging information is though a audio/video conference. In the teaching context, such a conference will have a large number of participants which will require high bandwidth availability [5]. To reduce the need for such bandwidth, the video streaming will be going exclusively from the professor to the students. The audio interaction will have the professor acting as a moderator and main speaker. The students will have to ask for permission to speak before being given control of the microphone.

Video is already used by many e-learning platforms, however it is used for publishing pre-recorded content that the students can view offline.

2.2. Threaded Instant Messaging.

Instant messaging is a very effective tool for real-time information exchange. The system will provide a specialized instant messaging feature, which will help the participants organize the discussion into threads, thus avoiding the usual confusion that appears in such conferences with regard to whom talks to whom and what answers belongs to which question. Figure 1 shows a concept drawing of how the threaded chat looks like. participants can ask side questions on existing topics, which can be either replied in their thread or linked to the answer already existing in another thread.

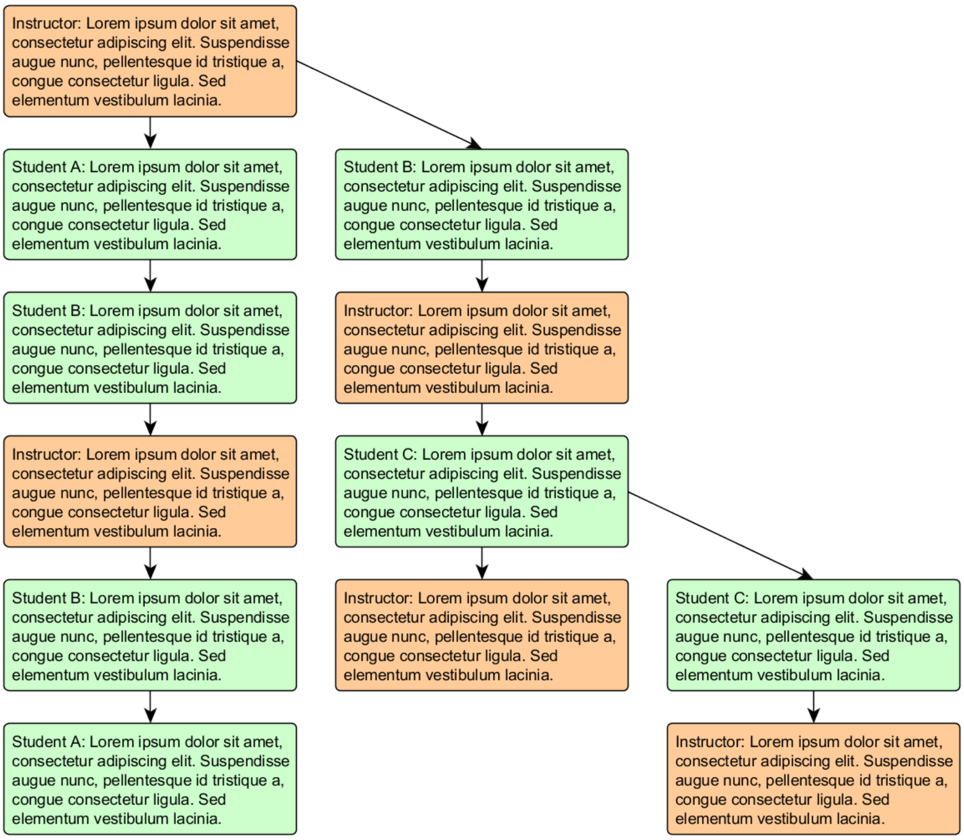

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Figure 1: Threaded instant messaging

2.3. **Remote Assistance.** Often enough students working independently at home face problems that they cannot solve, yet getting help from a professor proves time-consuming since they must schedule a meeting and sometimes they even have to bring their computer to show the issue. Web-based remote assistance tools are a proven technology which can be found as open source and commercial products. The Aport system will include such a feature to allow fast and effective student assistance.

There are already free solutions for remote desktop access (e.g. Mikogo [2]) but they are usually standalone applications.. We would like such a solution to be integrated with our portal without the need for additional plugins.

2.4. **Support for Students with Disabilities.** As technology becomes available, the access to higher education becomes available easier to students with disabilities such as lack of eye sight. Teaching computer science to a blind person raises serious challenges, but it is all the more rewarding. To assist such students in easily obtaining their information, the portal will be designed with an alternative hierarchical interface which is easier to comprehend through the use of an automated screen reader.

3. Dealing with Plagiarism

The easy access to information through the World Wide Web and the numerous tools for file sharing, make plagiarism a very tempting solution for students who want to solve their assignments fast and without effort. Accurate evaluations in this context are difficult and time consuming tasks, which take the professor's focus away from the main goal of the course.

3.1. **Prevention.**

Our approach to discouraging plagiarism is to create a large set of problems for each project and to arbitrarily assign them to students. This reduces the number possible solution sources, but also can lead to unfair assignment of several difficult problems to the same student. The system will provide means for marking each problem's difficulty and an algorithm for arbitrary assignment that keeps the overall difficulty level balanced among students.

3.2. **Detection.**

The system will also feature an integrated plagiarism detector which will compare each student's solution to an already existing set of solutions. The detector will be able to ignore certain blocks of source code that were provided by the professor as example in class and which consequently are naturally used by students in their solutions.

The plagiarism algorithm we are designing is inspired from the work of Goel, Rao et al in [3] and Schleimer, Wilkerson, and Aiken in [8]. We will analyze the source code in blocks with and without comments, and with and without taking into account the names of the variables and functions. The analysis result will report an overall similarity score as well as similarity reports between the major blocks. A mandatory feature is the possibility to ignore certain blocks when performing the comparison.

4. Assisting Frontal Teaching

4.1. **Presentation Slides.**

A major problem faced by students during frontal teaching is taking accurate and detailed notes while still following the flow of the lecture. While many succeed in this task there are even more who fail. The Aport portal will provide the professor with means of creating presentation slides that can be shown during lectures and on which the students can make on-line annotations at the same time. This will also provide the students with the possibility of sharing class notes in a uniform manner. The professor can also consult this notes and get a good insight into the student's understandings and confusions.

4.2. **Online Solution Review.** The portal will provide support for online solution review and annotation, with the possibility of attaching forum-like discussions to each annotation. This will reduce the amount spent in class explaining the issue, and leaving time for answering more specific questions from the students.

One challenge of the solution review is the possibility of annotating any file of the loaded solutions, regardless of their type and format. The solution will be to provide converters for all the accepted file types, that will transform the files into HTML code. Unknown files will be treated as test files by default, unless their type is known to be binary.

5. Automatic Grade Calculation

Calculating the grade can mean as little as performing a mean average of several scores or as complicated combining tens of grades and scores into a final grade. A large number of grades appears sometimes out of the need to keep the students working constantly during the semester and consequently providing weekly projects, quizzes, and homework. The portal will provide the professor with means of specifying the grade calculation algorithm either graphically or programmatically.

The easiest and most flexible implementation of this feature would offer the user a text box in which to right the grading algorithm in a programming language such as JavaScript. While this approach would be suitable for users familiar with programming, it would be unusable by the majority of users. We are investigating graphical solutions such as the Lily JavaScript Visual Programming Tool [1].

6. Effectiveness Evaluation And Feedback

The impact of an e-learning system on the students is determined among other things by the ease of use and consistent use cases. Finding the best way to present and navigate the information is a difficult problem, when lacking data to analyze. The portal will feature an integrated user feedback module and a web analytics engine which will help the authors evaluate and improve its effectiveness through interface changes.

7. Assisting Independent Practical Projects

Starting from the idiom "*practice makes perfect*", we consider offering our students the possibility to test code directly into the Aport portal. The motivation for such a facility is twofold:

- From the *student perspective* it provides ease of access and ease of use. This is mainly due to the familiarity of students with WEB applications even if they do not have enough background to use a compiler with all its features. Another advantage is that students do not have to install on personal computers these instruments in order to continue or complete the work within laboratory sessions and all their work (i.e. programs) are kept in the same place, that is accessible through a simple web browser. Moreover, having only one compiler or interpreter for a programming language assumes that there are no incompatibilities between different versions.
- From the *instructor* and *administrator* point of view, the software installation and maintenance in laboratories is significantly reduced and so is the account cleanup between exams. Another very important advantage that emerges for this integration is the feedback that an educator can gain from students work. Such insight can be utilized to improve course content and structure. For instance, determining student's most frequent mistakes can point out what concept misunderstood or poorly presented.

An integration of the C compiler and editor was presented in [6], while HTML, CSS and Javascript code can be edited in a textarea box and executed on tutorials from http://www.w3schools.com.

Implementing such facilities raise security challenges. However, we want to use dedicates servers to run the actual programs and maybe impose some limitations in the instruction sets. Moreover, due to the authentication phase we would be able to determine the origins of intended malicious code.

Acknowledgment

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