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PANTHER PEER: A WEB-BASED TOOL FOR PEER AND SELF EVALUATION

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ABSTRACT

Panther Peer is a novel web based tool for peer evaluation. It has been developed at the Florida Institute of Technology to enable students (specifically those involved in capstone design projects) to give one another anonymous feedback on their team performance. Panther Peer is simple to implement and completely automated. Panther Peer automates the process of peer evaluation and minimizes the workload for both instructors and students. With the benefits of automation students can gain feedback more quickly. Moreover, the reduction in workload for course instructors enables them to encourage peer evaluations. The primary advantage of this system is the feedback students receive from their peers which helps them identify their weaknesses and focus on their strengths. The automated process means that the collection and dissemination of information is highly efficient. From the peer evaluations by students, instructors can have a fair idea about the teams progress and intervene where deemed necessary.

INTRODUCTION

This paper describes the design, implementation, and use of an online student-team peer-evaluation tool named Panther Peer. It has been in use in the senior design course in mechanical

engineering at the College of Engineering, Florida Institute of Technology. Its primary purpose is peer feedback on team members for improved performance and team health. In addition it helps instructors evaluate the level of participation by team members and monitor team health. Evaluation of individual contributions in team based learning is a major challenge [1]. It has been demonstrated in many situations that students often learn from their peers in various ways [2]. An important focus in academic settings is the methodology used for determination of individual grades based on one's contribution to the team [3, 4]. Several studies indicate that the use of 360-degree feedback helps improve performance of both the individual and consequently the team [5, 6].

Panther Peer works on the principle that each student in a project group evaluates the other members of the project group and himself/herself by indicating how each member of the group has performed with respect to a number of predetermined parameters and rating them on a scale. The system allows students to get direct and timely feedback on their team skills. Students can track their skill development in particular areas (e.g., adaptability) and focus on improving them. Moreover, students learn how to use peer-based reviews for overall development.

There are various online survey tools providing 360-degree feedback mechanisms, viz., Qualtrics [7], SurveyMonkey [8],

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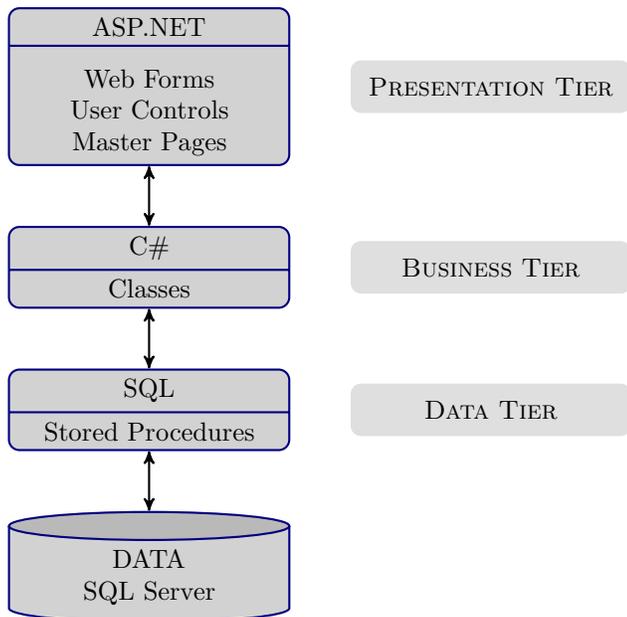


FIGURE 1. THREE-TIER ARCHITECTURE

etc. However, they are either commercial or do not have automated feedback mechanisms. In this work, we have developed a web-based peer evaluation system that assists evaluation and feedback in a project-based learning environment. Panther Peer is an ASP.NET based dynamic and interactive web-based system to facilitate 360-degree peer evaluation for student design project teams. Panther Peer enables instructors to define teams and the frequency of evaluation (e.g., weekly). The team members complete peer evaluations for all members of their design team including themselves at the required frequency. At the end of each evaluation period team members receive a report detailing their peer's evaluations of their performance. The instructor receives detailed reports on all participating teams.

SYSTEM ARCHITECTURE

The Panther Peer web based tool is based on a three tier architecture [9–11]. The basic parts of this architecture are shown in Fig. 1 and described as follows,

Presentation tier: The presentation tier contains the User Interface (UI) elements of the site and includes all the logic that manages the interaction between the visitor and the client's business. (Web forms, User controls, Master pages)

Business tier: The business tier receives requests from the pre-

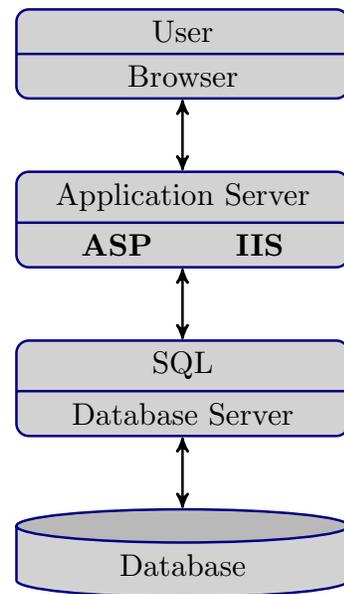


FIGURE 2. PANTHER PEER WORKFLOW

sentation tier and returns a result to the presentation tier depending on the business logic it contains. (C# classes)

Data tier: The data tier is responsible for storing the applications data and sending it to the business tier when requested. (SQL Server stored procedures)

The three-tier architecture ensures that the presentation tier never communicates directly with the data tier. In a three-tier model all communication must pass through the business tier. Stored procedures in the business tier act as an additional security layer. None of the users of Panther Peer can call the data layer directly. Instead the request must go through the business layer, thus providing security to the database. The workflow for the three-tier system is shown in Fig. 2. Any web browser (Internet Explorer, Firefox, Safari) can be used as the web client. Microsoft's Internet Information Server (IIS) is the web server and Microsoft SQL Server acts as the database server. The web page for the user is dynamically generated by the ASP code when the user accesses the web page. The browser sends a request to the web server. ASP.NET scripts process the input provided by the user, use the SQL to first validate the input, and then fetch appropriate data from the database. The data thus generated is then sent back to the web client.

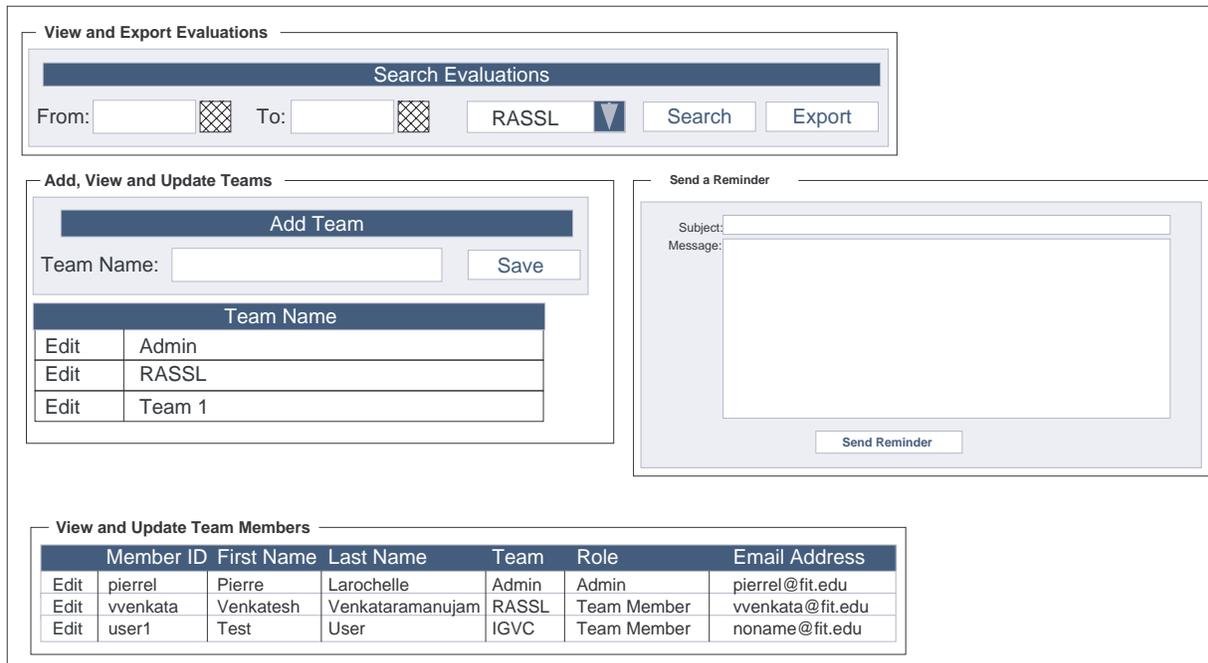


FIGURE 3. ADMIN PAGE

PANTHER PEER REQUIREMENTS

The minimum requirements for implementing the system are listed as follows:

Browser: Internet Explorer, Firefox, Safari

Web server: Internet Information Server (IIS)7

Database server: Microsoft SQL Server

Operating system: Microsoft Windows XP and later

Framework: Microsoft .NET

Mail server: Outgoing or Local SMTP mail server

The important process of sending feedback to the students and reports to the instructors is implemented in the following manner,

Windows: using the Windows Task Scheduler.

UNIX, Solaris: The *cron* daemon provides the ability for a system administrator or any other user (if permitted to do so) to automate the routine running of scripts, tasks or any other server function on a regular basis. The *cron* daemon is similar to the "scheduled tasks" tool on a Windows machine. More information on scheduling in UNIX using the *crontab* command may be obtained from [12, 13].

The reports can be scheduled at periodic intervals as desired by the instructor.

SYSTEM DESCRIPTION

This section contains a description of the different types of users in Panther Peer and the abilities that they possess. It also describes the creation of teams and user enrollment.

User Types

Students form the majority of users of Panther Peer. Team members and team leaders belong to this category. The students have the ability to,

- Submit evaluations
- Send email to the instructor
- Modify profile

Instructors have the ability to,

- Edit/Add students
- Edit/Add groups
- Send group emails
- Export evaluations

Team Name	
Edit	Admin
Edit	RASSL
Edit	Team 1

FIGURE 4. ADD/UPDATE PANEL

FIGURE 6. CREATE ACCOUNT (USER)

FIGURE 5. CREATE ACCOUNT (ADMIN)

To prevent instructors from inadvertently deleting data and causing database inconsistencies, deletion of team members and teams is carried out by the administrator of the SQL database. The administrator of the database also has the very dangerous ability to delete information, which can cause data inconsistency. Administrators should pay careful attention as it is possible to cause database inconsistencies with the powerful “delete/remove” command.

Using Panther Peer

The instructor creates teams by adding them in the “ Add, View and Update Teams” panel in Fig. 4 in the admin page of the website shown in Fig. 3. Instructors have two methods to add students into the Panther Peer system, viz.

Administrator Enrollment: To add students to a team the instructor enters the student details (username, password, first, last name and the team) into the “Create Account” page after logging in as an administrator. This method allows the

instructor to assign a role such as, “Team Member”, “Team Leader” or “Admin”, see Fig. 5. The administrator can then send the username and password to the students for use.

Team Member Enrollment: Team members can go to the “Create Account” page and create an account after entering their details and selecting their team, see Fig. 6.

Once the team members are enrolled in their respective teams, the system is ready to accept evaluations and send periodic reports to the instructor.

EVALUATION CRITERIA AND RUBRIC

The online evaluation form used in Panther Peer shown is based on the paper evaluation form used for the evaluation of capstone design teams at the Florida Institute of Technology. Peer evaluation is carried out by logging into the website and going to the “Evaluation Form” tab. The evaluation consists of drop down menus for selection of team members and the assignment of scores. Team members are evaluated based on the questionnaire listed in Table 1, where

$$A = 4, B = 3, C = 2, D = 1, F = 0$$

The other performance criteria listed in Part 2 of Table 1 are evaluated on a scale from 1 to 10, where

$$1 = \text{Very poor}, 10 = \text{Excellent}, \text{ or Not Applicable (N/A)}$$

The final score of a team member is based on the formula

$$Final\ Score = Z + 4 \times Q \quad (1)$$

where

Z - mean of the scores for the criteria listed in Part 2 of Table 1 (disregarding (N/A) entries), and

TABLE 1. EVALUATION FORM QUESTIONS

#	Question	Range
Part 1		
1	Was this member present at all group meetings?	(YES/NO)
2	Was this member an active participant in the group's activities?	
3	Would the group's accomplishments have been diminished if this person had not been a member of the team?	
4	What letter grade would you give to your group for its performance on the project?	(A - F)
5	What letter grade would you give to this member for their performance on the project?	
Part 2		
1	Teamwork (willing and able to work with others)	(1 - 10)
2	Technical ability (performing analyses, detailed design)	
3	Adaptability (ability to accept new ideas)	
4	Compliance with team deadlines (delivering work as promised)	
5	Communication skills (oral, written, graphical)	
6	Organizing and influencing the team's efforts	
7	Contribution (carrying his/her share of the load)	
8	Effectiveness during team meetings	
9	Manufacturing	

The screenshot shows a web interface titled "View and Export Evaluations". At the top is a dark blue search bar with the text "Search Evaluations". Below this are two input fields for dates, labeled "From:" and "To:", each with a small calendar icon to its right. To the right of the date fields is a dropdown menu currently displaying "RASSL" with a downward arrow. Further right are two buttons: "Search" and "Export".

FIGURE 7. VIEW/EXPORT EVALUATIONS

Q - Letter grade of member (Row #5 Table 1) - Letter grade of group (Row #4 Table 1).

The rubric used here can be modified as desired by the instructor either in the database itself or using Excel after downloading the evaluations.

VIEW/EXPORT EVALUATIONS

Evaluation submissions for a single group or all evaluations for a time period can be exported as an Excel file. The Excel file can then be saved and opened by Microsoft Excel or any other compatible spreadsheet program. The evaluation events for a date range can be viewed by selecting the time period and team and clicking on the search button in the "View and Export

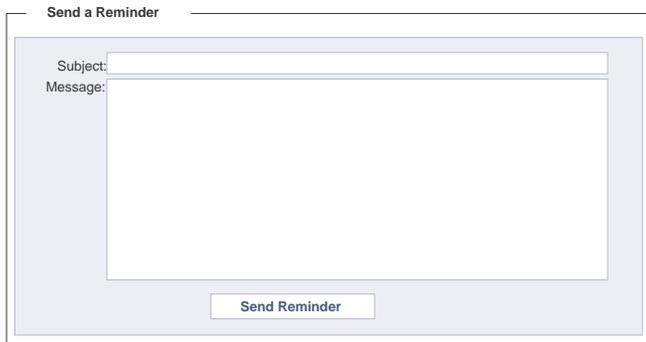


FIGURE 8. EMAIL PANEL

Evaluations” section on the “Admin” page shown in Fig. 7. The export of evaluations can be carried out by first selecting the date range followed by selecting the team from the drop-down menu. The evaluations can then be sorted and analyzed as desired. The actual time taken to export evaluations depends on the server load.

EMAIL FUNCTIONALITY

Panther Peer supports a convenient email function to send mass mail reminders to students to complete evaluations. Email reminders can be sent to all the enrolled team members. The email option can be found in the “Send a Reminder” panel in the “Admin” section, see Fig. 8. The email reminder can be configured to include the evaluation event details, the due date, a link to the website, and optionally a plain text message. The students can send email to the instructor via the “Contact Us” form on the web page.

OBSERVATIONS

Panther Peer was first used in the final course of a 3 part design curriculum in mechanical engineering at Florida Tech consisting of

MAE4190: Design Methodologies and Practice

MAE4193: Mechanical Design I

MAE4194: Mechanical Design II

This tool was implemented for Mechanical Design II (Spring 2010). The class consisted of 32 students with 3 to 12 members on each team. The students started using Panther Peer for peer evaluations after about 3 weeks of paper-based evaluations. The first week was used to test and gain feedback

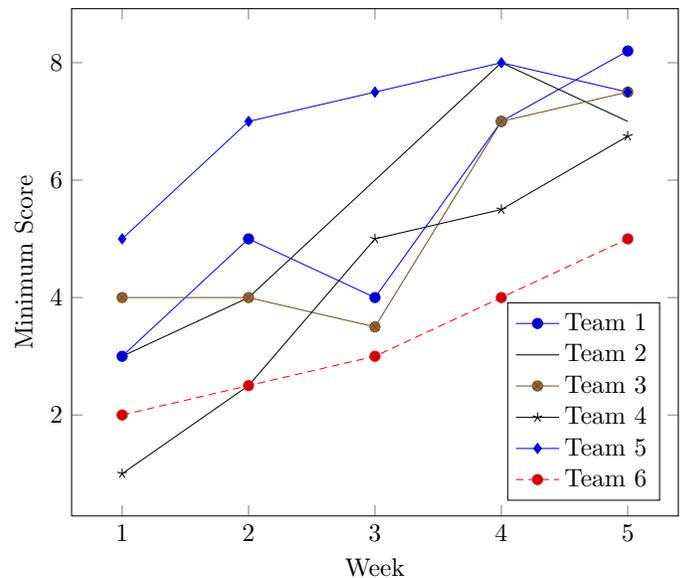


FIGURE 9. MINIMUM SCORES OF TEAM MEMBERS IN EACH TEAM OVER A 5-WEEK PERIOD

from the students. The team evaluations were carried out on a weekly basis with the automated feedback scheduled for Sunday. The plot in Fig. 9 shows the minimum score obtained by any team member in a team for that evaluation period. It is seen that there is an increase in the minimum scores of the team members over the course of the first 5 weeks of implementation. The maximum score indicating good team health as well as individual performance is 10. The scores showed less variation in the succeeding weeks.

Clearly the most interesting observation was the discussions that emerged spontaneously due to the periodic feedback of each other’s work. Also the instructors received periodic reports which helped them monitor and counsel team members and team leaders. With timely counseling from instructors and increased interaction between team members Panther Peer has served as a stimulus for improvement in individual and team performance. Due to the implementation of Panther Peer a lot of paper and man hours were being spared. This platform requires a stable network infrastructure and whenever the network is slow or unavailable the normal scheduling will be disturbed. This feedback mechanism is not really anonymous with small team sizes; however, it is beneficial in the long term leading to the overall improvement of team performance through better team interaction. Panther Peer has proven to be a useful tool in helping monitoring and assessing students in project based learning.

CONCLUSION

In this work, we present an integrated web-based system for peer evaluation. Peer evaluation of team members in team projects is a necessary and productive exercise that is beneficial for student learning in many ways. Through exposure to regular feedback, a student has the opportunity to assess and overcome one's drawbacks and improve on strengths. Feedback from peers can provide valuable information to improve future work. The process can foster professionalism and critical thinking skills. This saves a great deal of time and effort for the instructors who are teaching multiple sections of the same course or will be teaching the same course again and again. The system also reduces the lead time between the peer evaluation process and feedback to the student thus improving the students awareness during the course of the project. Panther Peer may be obtained by contacting the author(s) via email at pierrel@fit.edu.

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