AC 2009-1658: A WEB-BASED APPROACH TO SENIOR UNDERGRADUATE PROJECT MANAGEMENT

Hugh Jack, Grand Valley State University

Christopher Pung, Grand Valley State University

A Web Based Approach to Senior Undergraduate Project Management

Hugh Jack, Chris Pung
Grand Valley State University

Abstract

At Grand Valley State University undergraduate senior projects are done for companies using multidisciplinary groups of students. The projects include the design, fabrication, testing and delivery of i) production equipment, ii) test equipment, or iii) new product designs. The course runs over two semesters. During the first semester the students develop a detailed design proposal that is presented to the corporate sponsor. In the second semester students order and build components, do testing and debugging, and prepare for final delivery. At all stages the project sponsor is required to approve the project before it moves forward. Great care is taken to ensure that the projects meet all appropriate engineering and industrial standards at the proposal and final delivery phases. To this end the projects are overseen by faculty using common project management tools such as Gantt charts, budgets, proposals, and progress reports. Progress of the teams is reviewed on a weekly basis at a set common time by face-to-face meetings and with progress reports. Naturally coordinating and tracking the dozen or so teams of four to six students requires effort.

The common industrial approach to this problem is to use groupware from companies such as Novell, IBM, and Microsoft. While these can be powerful solutions, they can be difficult to deploy and maintain within a university IT structure. To this end an alternate solution was found using free public services, in this case provided by Google. In the first iteration the system was used for communication with Gmail and Google talk, document sharing with Gdocs (Google Documents), scheduling with Google Calendar, and web publishing with Google sites. Aside from signing up for a Gmail account the process is remarkably simple. The ability to set up groups, set sharing privileges, and track changes makes the system capable of services not possible with traditional course management systems.

This paper outlines how to use Google or similar services to manage senior and course projects. To this end the paper will be partially tutorial in nature, but special effort will be made to highlight the pedagogical values of the methods.

1. Introduction

At Grand Valley State University the senior project course¹ is interdisciplinary for all four undergraduate programs - Computer, Electrical, Mechanical, and Product Design and Manufacturing Engineering. Projects are solicited from local companies, project sponsors pay for materials, and then must sign off on the final project deliverables. Typical projects include the design, construction, and testing of production equipment, test equipment, or new product designs (See Figure 1). To obtain these results the project course is carefully managed for student

based innovative design monitored and guided by faculty. The stages of the senior project course are,

(fall)

- Students apply for senior projects.
- Faculty recruit projects from local companies.
- Companies submit application forms.
- Faculty screen the projects and assemble teams for the projects.
- Companies are notified of acceptance.

(January-April)

- Week 1 - Lectures start and student teams are assigned to projects. Students begin using Google to document and track their projects
- Week 2 - Students are given clearance to visit sponsors based upon prepared questions.
- Week 3 - Students prepare specifications and receive approval to present to sponsor.
- Week 4 - Sponsors sign off on specifications.
- Week 5 - Students submit design concepts and propose testing and prototyping plans.
- Week 6-7 - Students receive concept approval from project sponsors.
- Week 8-11 - Detailed design work leading to submission of draft design proposal.
- Week 12 - Dress rehearsal proposal presentation to faculty
- Week 13-15 – Proposal presentations to sponsors seeking approval

(May-July)

- Weeks 1-8 - Students order components, build parts, assembly systems, test, and prepare for delivery
- Weeks 9-12 - Sponsors review projects and prepare for sign-offs.
- Weeks 13-14 - Student teams resolve minor issues and prepare for the Senior Project Day

(August) Projects delivered

Figure 1 - Examples of Senior Projects

The management structure used for the projects includes multidisciplinary teams of 4-6 students with one faculty member acting as a primary manager, and one faculty member acting as a mentor to the teams. The manager tracks the progress of multiple projects and deals with general administrative details. The mentor has a much more flexible role to advise the team on various technical and professional issues with the team. The managers and mentors select grades for the students.

The structure of the project management process has evolved over the last decade based on positive and negative experiences with the teams. In the past students were guided and tracked with the following elements.

Logbooks - Used for day to day technical notes.

Progress Reports - Weekly reports including budgets, Gantt charts, and item status.

Meeting - Weekly, or bi-weekly meetings to ask questions, discuss issues, etc.

Conceptual Designs - Early design ideas to check student progress.

Design Proposal - A detailed design proposal including drawings, parts, schedules, budget, etc. for sponsor approval.

Presentations - The design proposal is formally presented to faculty and then to the sponsor.

Poster - A poster and a demonstration of the project is used at the end of the semester to present the students work to visitors.

Most of the project management tools are mature and have proven to be very effective with a couple of exceptions.

Logbooks - Were intended as a way to track student progress in a professional sense. Students were directed to carry it with them and make notes as they discover new information, make decisions, etc. In addition they were also directed to log their hours. In practice students are more likely to use computers as the tools of choice. The log books would be pushed to the side to make space for a laptop. Over the past few years the quality of notes in the books has decreased and entries are made less often. Simply put they were no longer the right tools for the job.

Weekly Progress Reports - became an artificial way to track the team. To prepare for a progress report students would meet once a week, sometimes update the budgets and Gantt charts, and then write benign statements to describe progress and issues. In effect the progress reports became a time consuming extra task that did not effectively reveal true team progress and issues.

Beginning in the 2007/2008 project cycle Google Docs was used on a limited scope to share documents. The result was very positive so this year various Google tools have been deployed on a large scale to support the projects. In effect it has become a groupware solution like that used by many companies.

This paper discusses these tools and how they are used to help manage senior project courses more effectively.

2. Google Services

First, it is worth noting that the services that Google offers can be purchased from them with additional space, uptime guarantees, and features. It is also worth noting that similar free services are also available from other providers. Many of these services can also be found in common university software such as Blackboard. So while this work uses Google services, there is no intention to introduce commercialism or exclusively represent these as unique.

The primary reason for selecting of Google was the single site offering and integration of these services. Some of the services used are listed below.

Gmail - The basis for all of the other services. This account is used as a gateway.

Google Chat - a built in chat client, including options for video chat. Text chats are automatically recorded for later review.

Google Sites - Students may create web sites that are private or publicly viewable. Editing privileges can be shared with other users. It is also possible to upload files and attachments

Google Docs - A user can create spreadsheets, text documents, data entry forms, and presentations that can be shared and edited by other users simultaneously (note this is a very important feature for teamwork).

Google Groups - A group can be set up to hold common pages, share files, host threaded discussions, and more. Membership of the group can be controlled to structure access.

Google Calendars - Many of the students use the calendar function to coordinate team member schedules.

The Google site provide up to 7GB of space per user without charge. This is more than enough to host most project files. Privacy is an issue with projects, but Google specifically states that files that are not shared will be kept confidential. In addition, users have the ability to set sharing settings that include view and edit files and sites that are open to anybody on the Internet, people who sign in, and specific users on gmail. All of these services can be interlinked and launched from any google service page.

3. Tracking Projects

The basic steps used for the services in the course are listed below.

1. Before the course began students and faculty were directed to obtain a Gmail account. These were then used to set up basic access to documents and other Google services..
2. Before the first class a tracking Google Docs spreadsheet² (more detail later) was created and shared with the student group, course managers, and the team mentor.
3. During the first class students were asked to edit the sheet to include team specific details.
4. Students were directed to create a Google Site, or Google Group to host individual notes, and team notes. Approximately a third chose the Groups, but in hind-sight it would have been more effective to have all teams use it.
5. Team progress is tracked by the mentors and managers using the spreadsheet, individual, and team pages.

The student project team documents both individual and collective progress through a common spreadsheet, common web/group pages, and individual web/group pages.

3.1 The Spreadsheet

A project tracking spreadsheet was created as a common document that centralizes team tracking. The spreadsheet can be opened and edited by multiple users so that team members may keep it active and make frequent updates while they work. It also permits other team members, mentors, and managers to track the team progress in real-time. This eliminated the need for weekly progress reports. The spreadsheet is divided into pages as listed below,

1. Overview - a page for tracking the team at a glance - hours, names, budget, etc.
2. Meeting minutes - a running log of open items, person responsible, and status.
3. Budget - to track all projected and actual expenses.
4. Gantt - to track the progress of major project tasks.
5. Hours - Each team member has a page to track their hours and tasks completed.
6. Specifications - The project specifications are listed with numerical values.
7. Schedule - A combined schedule for the students to identify common work and meeting times.
8. Contacts - A page with contact information for all people the team contacts, including the team member who is the primary contact.
9. Concepts - The team itemizes major design concepts and alternatives. Each of these is assigned a risk score that is used to focus the team effort and select the final design.
10. Prototyping and Tests – Testing to validate prototype proof of concepts and specification is documented here. Each test is related to specific design specifications and test/prototype outcomes

To date this method has proven to be quite advantageous including the items listed below.

- Students track items as they work with their computers.
- Updates could be tracked for management purposes. This is similar to the tracking done with paper logbooks.
- Information was presented to everybody in a consistent format.
- Team members were able to track each others progress.

As with any approach there are also some negative aspects to the method.

- non-computer related activities (e.g., building and testing) require extra steps to update the spreadsheet.
- the format is fixed and so non-anticipated activities are hard to incorporate. This will require refinement over time, and the willingness to accept variations in the format.

3.2 Group and Individual Pages

To replace the function of the log books for taking notes students are asked to maintain a 'notebook' in Google Sites or Groups. The stated objective for these pages is that as students do their work it should appear in their individual pages with corresponding time log entries in the team spreadsheet. These pages provide an easily accessible place to store notes that are shared with their team-mates, mentor, and manger. The notes on individual pages document preliminary work by an individual team member. Once the individual work has matured to the point where it was ready for use by the team it is added to the team page. The team pages are used for common and agreed upon elements of the team work. The team page links to the student pages to make it a single landing point for all project activity.

Previously, when using the logbooks, the contents of notes were only available to the student, unless physically shared with their colleagues or submitted for grading. With the shared notes the students have a much greater motivation for quality because their peers will see it, and timeliness because they never know when it will be graded.

Students were given a choice for keeping notes. Google Sites provides the ability to create web pages with places for discussions (open to the Internet, with limited shared, or non-shared). Google Groups allows students a common place to keep notes and hold threaded discussions. Regardless of the choice of Google sites or Groups the students were also able to hold conversations about items and work on a common document without the 'hand-off' problems created by logbooks. However, at this point there is a slight advantage in the presentation of in Google Groups, thus it will be the tool of choice in the 2009/2010 offering of the senior project course.

4. Grading and Tracking

The use of computer based tools allows much more flexibility for faculty grading and tracking. Materials can be graded at the instructors leisure without the need for students to submit reports. During the first couple of weeks it is important to review the materials a few times and send email to the teams or individuals. This creates an environment where the students update documents as they work within an environment of continual expectation (i.e., quality is not driven by last minute work before deadlines). The team spreadsheet allows a fairly quick assessment of the team progress. Although we do not do so, it is possible to assign weekly grades by reviewing the spreadsheet and notes pages.

5. Conclusion

At the time of writing the new method was in use for one month and all signs point to a very successful introduction. By the time of final submission (April 2009) the authors expect to provide some anecdotal assessment data that describes the success of the approach.

Bibliography

1. Jack, H., "[GVSU Senior Projects](http://sites.google.com/site/gvsuseniorprojects/)", <http://sites.google.com/site/gvsuseniorprojects/>.
2. Jack, H., "[Project Management Template](http://spreadsheets.google.com/ccc?key=p0zgzjnK3tWY8GKr8eVfNUg)", <http://spreadsheets.google.com/ccc?key=p0zgzjnK3tWY8GKr8eVfNUg>.