



Applying Scrum to Manage a Senior Capstone Project

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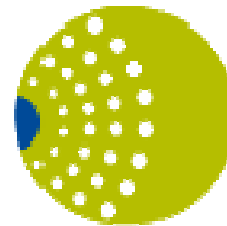


CS Senior Capstone Project

- Two consecutive semesters
 - CS460 (Senior Capstone Project I) in Fall
 - CS465 (Senior Capstone Project II) in Spring
 - Collecting requirements in Summer
 - From Summer 2015 to Spring 2016
- Sponsor



Allen County
Public Library



Audio
READING SERVICE

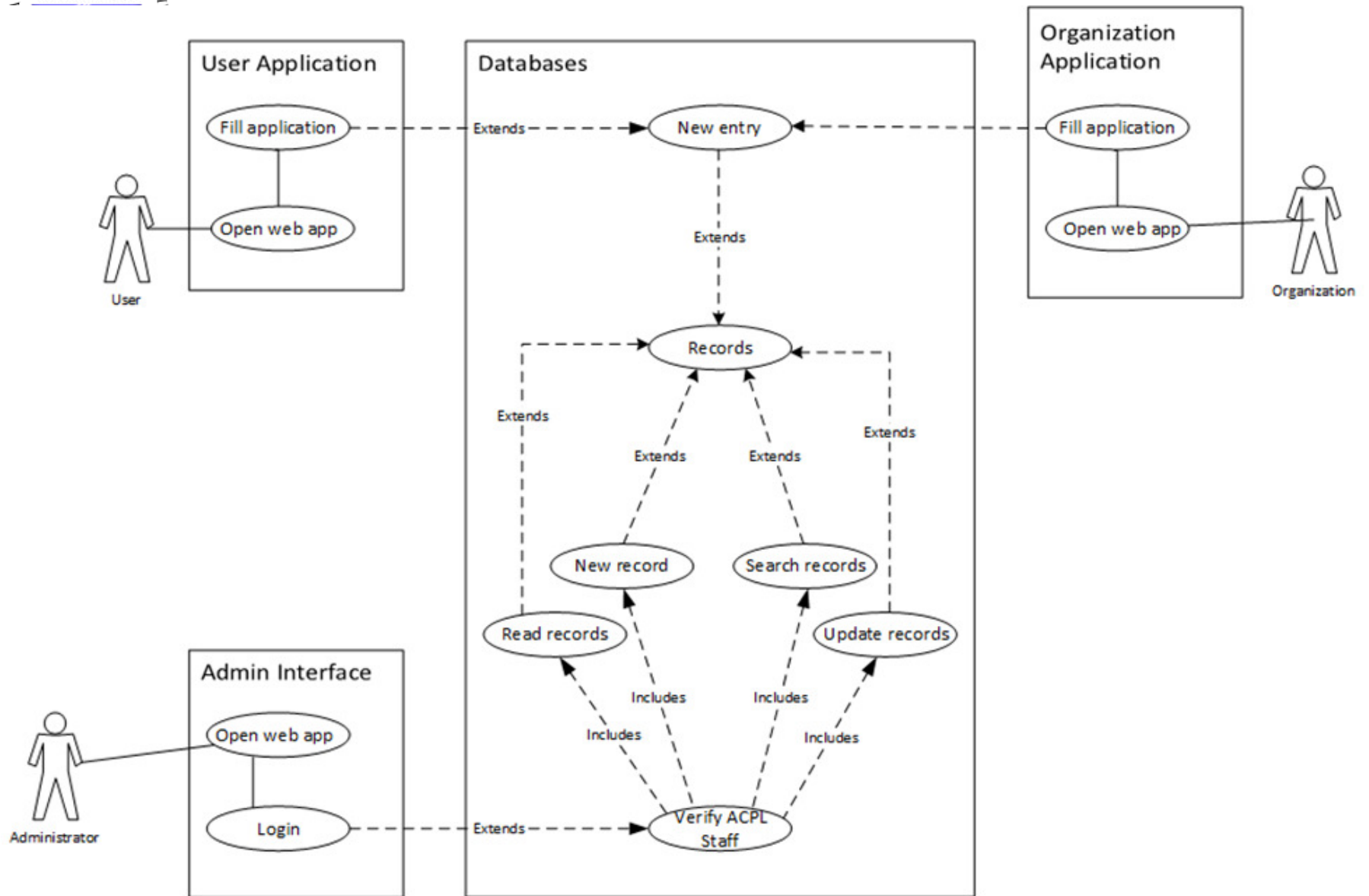
A department of the Allen County Public Library



Our Senior Capstone Project

- Design a Web application for ACPL
 - Collect the information of library users
 - Assign audio radios to them
- Users with disabilities
 - Difficult to hold a book or turn pages
 - Stroke, Parkinson's, and arthritis
 - Unable to read conventional printed materials
 - Blindness, low-vision, or a literacy issue

System Structure of Our Web Application





Main Challenges

- **Ease of use**
 - Accessible to people with visual or reading impairment
- **Eliminating errors**
 - Will not be continued by other students in the future
- **IEEE standards education grant**
 - Americans with Disabilities Act (ADA) compliance standards
 - ISO/IEC/IEEE International Standard 23026-2015



Issues with Traditional Project Management Method

- Waterfall approach
 - Misalignment between the software project and customers' requirements
 - Late or delay development of the project
 - Uneven distribution of workloads



Related Work

- Reichlmayr reported on the experiences of conducting a team project in an introductory software engineering course using Agile development techniques [1]
- Fox and Patterson used Rails, a highly productive programming framework, to introduce Agile processes in their software engineering courses [2]
- Mahnic described the observations of the behavior of developers using Scrum for the first time in a capstone course in [3]



Different from Previous Works

- Work with real customers
- Produce a final product in public use
- Emphasize the importance of applying online tools
 - Pivotal Tracker
 - GitHub



Outline

- Scrum Overview
- Applying Scrum to Our Senior Capstone Project
- Evaluation and Outcomes of Our Senior Capstone Project



Scrum

- An Agile approach
- Manifesto for Agile software development
 - Individuals and interactions over processes and tools
 - Working software over comprehensive documentation
 - Customer collaboration over contract negotiation
 - Responding to change over following a plan
- Scrum is a widely adopted industry standard for building business software



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Three Principles from Scrum

- Working closely with customers
- Incremental development
- Weekly Scrum



Working closely with customers

- Monthly meetings with ACPL
 - Review what we had built
 - Provide us timely feedback

Avoid the issue of the misalignment between the software project and customers' requirements!



Incremental development

- Implement an increment every month
- Implement the most important items first

Avoid the issue of the late or delayed development of the project!



Pivotal Tracker System

The screenshot displays the Pivotal Tracker interface for a project named "Audio Reading Service Listener Web". The browser address bar shows the URL <https://www.pivotaltracker.com/n/projects/1410876>. The interface includes a navigation menu on the left with options like "Add Story", "My Work", "Current", "Backlog", "Icebox", "Done", "Epics", "Labels", and "Project History". The main content area is divided into two columns: "Current" and "My Work".

Current Column:

- Weekly Scrum meeting (AL, SS, DB) - Finish
- Admin interface design (DB, SS, ZC) - Finish
- Presentations (AL, SS, ZC) - Finish
- Database import/export (ID: #111841395) - Feature, 3 Points, State: Finish Started, Requester: Daniel Brewer, Owners: AL, SS, ZC. Updated: 28 Apr 2016, 11:56pm.

My Work Column:

- Admin interface design (DB, SS, ZC) - Finish
- Presentations (AL, SS, ZC) - Finish
- Database import/export (AL, SS, ZC) - Finish
- Database Modifications (DB, SS, ZC) - Finish
- Server-side php (ID: #112690365) - Feature, 3 Points, State: Finish Started, Requester: Aaron Lilley, Owners: SS, DB, ZC. Updated: 8 Mar 2016, 8:48pm.

Each story card includes a description, labels, and a task section. For example, the "Database import/export" story has a description: "Import and export .xml (maybe .csv) files to and from the database. Estimation: 20 hours".



GitHub Repository

The screenshot shows a web browser window displaying the GitHub repository page for 'sharsz01/acplZend'. The browser's address bar shows the URL 'https://github.com/sharsz01/acplZend'. The repository name 'sharsz01 / acplZend' is prominently displayed at the top, along with statistics: 4 watchers, 0 stars, and 0 forks. Below this, navigation tabs for 'Code', 'Issues', 'Pull requests', 'Projects', 'Wiki', 'Pulse', and 'Graphs' are visible. The repository description reads 'ACPL project using the Zend framework'. A progress bar indicates 284 commits, 1 branch, 0 releases, and 3 contributors. Action buttons include 'New pull request', 'Create new file', 'Upload files', 'Find file', and 'Clone or download'. A commit history table is shown, with the most recent commit by 'brewdd02' on July 7, 2016. The commit message is 'Update RadioApplicationForm.php'. The table lists several files and folders: 'application', 'docs', 'nbproject', 'public', 'tests', and 'README.md'. The 'README.md' file is selected, showing its content: 'acplZend' and 'ACPL project using the Zend framework'.

File/Folder	Commit Message	Time Ago
application	Update RadioApplicationForm.php	7 months ago
docs	Add files via upload	9 months ago
nbproject	Adding initial version of modified project using the Zend framework f...	a year ago
public	Update admin.js	8 months ago
tests	Added current tests for populating a data table with ajax and some of...	a year ago
README.md	Initial commit	a year ago



Weekly Scrum

■ Answers to three questions

- What did I accomplish since the last weekly Scrum?
- What do I plan to work on by the next weekly Scrum?
- What are the obstacles or impediments that are preventing me from making progress?

Avoid the issue of the uneven distribution of workloads among students!



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Evaluation and Outcomes

- Web service provided to ACPL
- Response from ACPL customers
- Response from students



Web service provided to ACPL

- <https://arsdatabase.acpl.lib.in.us/RadiosApp/public/index.php/Index>
- <https://arsdatabase.acpl.lib.in.us/RadiosApp/application/login/loginForm.php>



Online Application Forms



Home

Radio Applications ▾

APPLICATION FOR AUDIO READING SERVICE RADIO

Allen County Public Library * Audio Reading Service

7615 DiSalle Blvd * Fort Wayne IN 46825 * 260.421.1376

audioreader@acpl.info

Fields marked with * are required

Listener

Name

First Name *

Last Name *

Date of Birth *

Address

Street Address *

Address Line 2

City *

State *

Zip *



Admin Interface



Logout

Home Listeners Listener Details Organizations Organization Details Radios Radio Details User Management

Notifications

Unread alert - Organization Application

IPFW has applied for radios on 2016-04-29

View Details

Dismiss

Unread alert - Organization Application

temp has applied for radios on 2016-04-29

View Details

Dismiss



Response from ACPL Customers

■ Newsletter of ACPL

□ *“A new, efficient listener and radio inventory database with a streamlined online application. This was made possible because of a collaboration with IPFW’s Computer Science department; three students created this for us as their Senior Capstone project.”*

■ Email from ACPL managers

□ *“We very much appreciated your help and the work that your students put into their project. It has helped our organization of listeners immensely.”*



ACPL Volunteer Recognition Celebration

"WHAT YOU DO IS AWESOME!"



VOLUNTEER RECOGNITION CELEBRATION

..... *Join us!*

Thursday, June 9, 2016 • 12 noon–1:30 pm for Lunch and Recognition

The Towne House Retirement Center
2209 St. Joe Center Road • Fort Wayne

Seating begins at 11:40 pm • Lunch is served at 12:05 pm
Volunteers may attend with a guest

Limited seating • Please RSVP on or before June 1st by:

• **Phone:** (260) 421-1376
• **Email:** abryan@acpl.info
• **Mail:** Return enclosed card

Parking is around back. Enter through Door 6 in the back and turn right in the hallway. A map of the campus is enclosed.





Response from Students

CS 465 (Spring 2016)

#	Question	Individual Evaluation Score	Department Evaluation Score
7	Instructor's knowledge of subject	4.00	3.50
8	Instructor's ability to present	4.00	3.07
9	Instructor's enthusiasm	4.00	3.42
10	Instructor's concern individual	4.00	3.29
11	Instructor overall	4.00	3.21
12	The class content	3.67	3.20
15	Assignment related to course	4.00	3.35
16	Exams measured understanding	4.00	3.27
17	The course overall	4.00	3.22
	Average of statements 7-12 & 15-17	3.96	3.28

CS 460 (Fall 2015)

#	Question	Individual Evaluation Score	Department Evaluation Score
7	Instructor's knowledge of subject	4.00	3.53
8	Instructor's ability to present	3.67	3.12
9	Instructor's enthusiasm	4.00	3.47
10	Instructor's concern individual	4.00	3.33
11	Instructor overall	4.00	3.31
12	The class content	3.67	3.20
15	Assignment related to course	4.00	3.40
16	Exams measured understanding	4.00	3.25
17	The course overall	4.00	3.25
	Average of statements 7-12 & 15-17	3.93	3.32

Section: 23163 - Senior Capstone Project II CS 46500-07

	ABET Criteria	Strongly Agree (5)	Agree (4)	Neither Agree nor Disagree (3)	Disagree (2)	Strongly Disagree (1)	Average
I am able to apply software engineering principles and skills to a team-oriented software project.	abcdik	2	1	0	0	0	4.67
I am able to construct a software project schedule and track its progress.	aik	3	0	0	0	0	5.00
I am able to construct artifacts appropriate to demonstrate completion of each phase of the software process.	aik	1	2	0	0	0	4.33
I am able to conduct formal technical reviews.	fk	2	1	0	0	0	4.67
I am able to utilize a repository for project artifacts.	aik	3	0	0	0	0	5.00
Total		11	4	0	0	0	4.73

Section: 13260 - Senior Capstone Project I CS 46000-07

	ABET Criteria	Strongly Agree (5)	Agree (4)	Neither Agree nor Disagree (3)	Disagree (2)	Strongly Disagree (1)	Average
I am able to apply software engineering principles and skills to a team-oriented software project.	abcdik	2	1	0	0	0	4.67
I am able to construct a software project schedule and track its progress.	aik	2	1	0	0	0	4.67
I am able to utilize a repository for project artifacts.	aik	3	0	0	0	0	5.00
I am able to construct artifacts appropriate to demonstrate completion of each phase of the software process.	aik	3	0	0	0	0	5.00
I am able to conduct formal technical reviews.	fk	1	2	0	0	0	4.33
Total		11	4	0	0	0	4.73



Conclusions

- Scrum method contributed **significantly** to the success of our senior capstone project
- We overcame several **challenges** faced by the traditional waterfall approach
- We believe that Scrum serves as a **better** project management method than waterfall for undergraduate senior capstone projects in computer science



References

1. T. Reichlmayr, “The Agile Approach in an Undergraduate Software Engineering Course Project,” 33rd ASEE/IEEE Frontiers of Education Conference, November 5-8, 2003, Boulder, CO.
2. A. Fox and D. Patterson, “Viewpoint: Crossing the Software Engineering Chasm,” *Communications of the ACM*, Vol. 55 No. 5, pp 44-49, May 2012.
3. V. Mahnic, “A Capstone Course on Agile Software Development Using Scrum,” *IEEE Transactions on Education*, Vol. 55, No. 1, pp 99-106, February 2012.



Thanks for your attention

