
Crowd Science Mapper

Senior Design Final Documentation

Crowd Science

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Contents

Title	i
Contents	vi
List of Figures	vii
List of Tables	ix
List of Algorithms	xi
Overview Statements	xiii
0.1 Mission Statement	xiii
0.1.1 Product Description	xiii
0.1.2 Goals	xiii
0.2 Elevator Pitch	xiii
Document Preparation and Updates	xv
1 Overview and concept of operations	1
1.1 Team Members and Team Name	1
1.2 Client	1
1.3 Project	1
1.3.1 Purpose of the System	1
1.4 Academic Need	1
1.5 Deliverables	2
1.6 System Description	2
1.6.1 Generic Event Reporting	2
1.6.2 Generic Event Viewing	2
1.7 Systems Goals	2
1.8 System Overview and Diagram	2
1.9 Technologies Overview	2
2 User Stories, Requirements, and Product Backlog	5
2.1 Overview	5
2.2 User Stories	5
2.2.1 User Story #1	5
2.2.2 User Story #2	5
2.2.3 User Story #3	5
2.3 Requirements and Design Constraints	5
2.3.1 System Requirements	5
2.3.2 Network Requirements	5
2.4 Product Backlog	6
2.4.1 Navigation Bar	6
2.4.2 New User Registration	6

2.4.3	User Login	6
2.4.4	Event reporting interface	6
2.4.5	Detailed event list	7
2.4.6	Map representation of events	7
2.4.7	User selection of data to view	7
3	Project Overview	9
3.1	Team Member's Roles	9
3.2	Project Management Approach	9
3.3	Stakeholder Information	9
3.3.1	Customer or End User (Product Owner)	9
3.3.2	Management or Instructor (Scrum Master)	9
3.3.3	Investors	9
3.3.4	Developers –Testers	10
3.4	Budget	10
3.5	Intellectual Property and Licensing	10
3.6	Terminology and Acronyms	10
3.7	Phase Overview	10
3.8	Sprint Schedule	10
3.9	Timeline	10
3.10	Backlogs	11
3.10.1	Sprint 1 Backlog	11
3.10.2	Sprint 2 Backlog	11
3.10.3	Sprint 3 Backlog	11
3.10.4	Sprint 4 Backlog	11
3.10.5	Sprint 5 Backlog	11
3.10.6	Sprint 6 Backlog	12
3.11	Development Environment	12
3.11.1	Development IDE and Tools	12
3.11.2	Source Control	12
3.11.3	Dependencies	12
3.11.4	Build Environment	12
3.11.5	Development Machine Setup	12
4	Project Revisions	13
4.1	Overview and Concept of Operations	13
4.1.1	Event Set Editing	13
4.2	User Stories, Requirements, and Product Backlog	13
4.2.1	User Story #4	13
4.2.2	User Story #5	13
4.2.3	Administrator editing of existing events	13
4.2.4	Administrator customization of event sets	14
4.3	Project Overview	15
5	Design and Implementation	17
5.1	Architecture and System Design	17
5.1.1	Design Selection	17
5.1.2	Data Structures and Algorithms	17
5.1.3	Data Flow	17
5.1.4	Communications	17
5.1.5	Classes	17
5.1.6	UML	17
5.1.7	GUI	17
5.1.8	MVVM, etc	17
5.2	Major Component #1	17
5.2.1	Technologies Used	17

5.2.2	Component Overview	17
5.2.3	Phase Overview	18
5.2.4	Architecture Diagram	18
5.2.5	Data Flow Diagram	18
5.2.6	Design Details	18
6	System and Unit Testing	19
6.1	Overview	19
6.2	Dependencies	19
6.3	Test Setup and Execution	19
6.4	System Testing	19
6.5	System Integration Analysis	19
6.6	Risk Analysis	19
6.6.1	Risk Mitigation	19
6.7	Successes, Issues and Problems	19
6.7.1	Changes to the Backlog	19
7	Prototypes	21
7.1	Sprint 1 Prototype	21
7.1.1	Deliverable	21
7.1.2	Backlog	21
7.1.3	Success/Fail	21
7.2	Sprint 2 Prototype	21
7.2.1	Deliverable	21
7.2.2	Backlog	21
7.2.3	Success/Fail	21
7.3	Sprint 3 Prototype	22
7.3.1	Deliverable	22
7.3.2	Backlog	22
7.3.3	Success/Fail	22
7.4	Sprint 4 Prototype	22
7.4.1	Deliverable	22
7.4.2	Backlog	23
7.4.3	Success/Fail	23
7.5	Sprint 5 Prototype	23
7.5.1	Deliverable	23
7.5.2	Backlog	23
7.5.3	Success/Fail	23
	Software Agreement	SA-1
A	Product Description	A-1
1	Project Title	A-1
2	Proposed/Advised by	A-1
3	Project Description	A-1
4	Useful Links	A-1
5	Project Duration	A-2
6	Technical Areas Encompassed	A-2
7	Number of Students/Disciplines required	A-2
B	Sprint Reports	B-1
1	Sprint Report #1	B-1
1.1	Team Members	B-1
1.2	Project Sponsors	B-1
1.3	Sponsor/User Description	B-1
1.4	Project Overview	B-2

1.5	Project Environment	B-2
1.6	Project Deliverables	B-2
1.7	Backlog	B-2
1.8	Potential Issues	B-2
2	Sprint Report #2	B-3
2.1	Backlog Completed	B-3
2.2	Prototype Features	B-3
2.3	Meetings	B-3
2.4	Client Communication	B-3
2.5	Sprint 3 Backlog	B-3
3	Sprint Report #3	B-3
3.1	Backlog Completed	B-3
3.2	Prototype Features	B-4
3.3	Meetings	B-4
3.4	Client Communication	B-4
3.5	Sprint 4 Backlog	B-4
3.6	Sprint 3 Issues	B-4
4	Sprint Report #4	B-4
4.1	Backlog Completed	B-4
4.2	Prototype Features	B-4
4.3	Client Communication	B-4
4.4	Revised Deliverables	B-5
4.5	Sprint 5 Backlog	B-5
4.6	Sprint 6 Backlog	B-5
4.7	Sprint 4 Successes/Issues	B-5
C	Industrial Experience and Resumes	C-1
1	ABET: Industrial Experience Reports	C-1
1.1	Hannah Aker	C-1
2	Resumes	C-1
D	Acknowledgment	D-1

List of Figures

1.1	Design of Crowd Science Main Page	3
3.1	Gantt Chart of Project Completion Schedule	11
4.1	Design of Crowd Science Main Page	14
7.1	Crowd Science Main Page Prototype as of Sprint 1	22
7.2	Crowd Science Main Page Prototype as of Sprint 2	23
7.3	Crowd Science Login Page Prototype as of Sprint 2	24
7.4	Crowd Science Register Page Prototype as of Sprint 2	24
7.5	Crowd Science Main Page Prototype as of Sprint 4	25
7.6	Crowd Science Register Page Prototype as of Sprint 4	25
7.7	Crowd Science Login Page Prototype as of Sprint 4	26
7.8	Crowd Science Event Set Selection Prototype as of Sprint 4	26

List of Tables

1.1 Technologies Used	4
---------------------------------	---

List of Algorithms

1	Remote Desktop Connection (.rdp) file	12
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Overview Statements

0.1 Mission Statement

0.1.1 Product Description

Crowdsourcing is a method of gathering information from a large group of people, especially from internet users, rather than employing more traditional methods to compile information. Right now, there are several ongoing crowdsourcing projects, such as the USGS Did You Feel It (DYFI) project, USGS Butterflies and Moths of North America (BAMONA) project, and Cornell's eBird project. Crowdsourcing reduces time and cost for data acquisition and enhances the accuracy and generality of research results.

The Crowd Science Mapper will be a generic crowdsourcing toolkit, easily adaptable to any kind of information being gathered. Ordinary citizens will be able to report information via an event reporting interface and view information with an event viewing interface. Academics and Researchers will be administrators in the system, and will not need programming experience. System administrators will be able to moderate event reports and create and modify sets of event reports through a graphical user interface.

0.1.2 Goals

The goal of this project is to distribute a finalized toolkit or API to researchers and general public by 2022. The first part of this goal is to create a tool that is versatile for any type of data researchers want to research, easy and intuitive enough for any user to report events and view data, and reliable and secure enough for academic use. The second part of this goal will be to distribute that tool to a wide range of people to provide a wide range of data points for researchers using the tool to collect data.

0.2 Elevator Pitch

Crowdsourcing aims at getting massive amounts of information from the online community. There are several individual crowdsourcing projects, collecting information about earthquakes, birds, butterflies, and more. The Crowd Science Mapper will be a generic crowdsourcing toolkit, that can accommodate any kind of information that researchers are gathering, and won't require any technical know-how to use.

Document Preparation and Updates

Current Version [2.4.1]

Prepared By:
Hannah Aker

Revision History

<i>Date</i>	<i>Author</i>	<i>Version</i>	<i>Comments</i>
<i>9/14/15</i>	<i>Hannah Aker</i>	<i>1.1.0</i>	<i>Duplicated design template for editing</i>
<i>9/30/15</i>	<i>Hannah Aker</i>	<i>1.1.1</i>	<i>First draft of requirements section</i>
<i>10/30/15</i>	<i>Hannah Aker</i>	<i>1.2.0</i>	<i>Add sprint reports, refine system template, refine requirements, filled in project and mission/elevator section</i>
<i>11/14/15</i>	<i>Hannah Aker</i>	<i>1.3.0</i>	<i>Finished requirements.</i>
<i>11/15/15</i>	<i>Hannah Aker</i>	<i>1.3.1</i>	<i>Finished overview and added resume.</i>
<i>11/27/15</i>	<i>Hannah Aker</i>	<i>1.3.2</i>	<i>First draft of design section</i>
<i>12/10/15</i>	<i>Hannah Aker</i>	<i>1.3.3</i>	<i>Cleaned out document, added prototype, industrial experience, sprint 2 report and sprint 3 report sections.</i>
<i>1/5/16</i>	<i>Hannah Aker</i>	<i>1.3.4</i>	<i>Transitioned document to new format, revised mission statement and overview sections.</i>
<i>1/31/16</i>	<i>Hannah Aker</i>	<i>2.4.0</i>	<i>Finished revisions to mission/elevator, requirements, overview, and project overview sections. Added new section project revisions.</i>
<i>2/11/16</i>	<i>Hannah Aker</i>	<i>2.4.1</i>	<i>Brought prototype section up to date with project, added sprint 4 report.</i>

Overview and concept of operations

This section covers an overview of the Crowd Science Mapper. This section will contain information about the purpose, goals, major system components, and technology used.

1.1 Team Members and Team Name

Original team members were Jiasong Yan and Hannah Aker. Jiasong Yan was removed from the team in January 2016. Project revisions regarding the team member removal can be found in Chapter 4. Current team members include Hannah Aker. The team is named “Crowd Science”.

1.2 Client

Clients are Dr. Mengyu Qiao, assistant professor at South Dakota School of Mines and Technology (SDSMT) in the Computer Science Department, and Gail Schmidt, software engineer at Stinger Ghaffarian Technologies (SGT).

1.3 Project

The Crowd Science Mapper project entails creating a proof-of-concept generic crowdsourcing website. This website will demonstrate that crowdsourcing can be accomplished with generic, easy to use interfaces. This interface will allow ordinary users to report information with an event reporting interface and view information with an event viewing interface.

1.3.1 Purpose of the System

As a proof-of-concept project, the purpose of this project is to prove that a generic interface for ordinary users to report events and view events can be created and implemented.

1.4 Academic Need

Currently, there exist various crowd science mappers designed and implemented for a specific set of events, such as bird sightings and butterfly sightings. Most researchers would need to contract a software designer to implement a crowdsourcing tool for a specific research area, costing time and money. A generic, open-source toolkit or website would provide researchers an easy to use, generic crowdsourcing tool.

1.5 Deliverables

The deliverables in this project will be a proof-of-concept generic crowd sourcing website. This website will feature interfaces for users to view events and report events. The scope of this project does not include mobile applications.

1.6 System Description

1.6.1 Generic Event Reporting

Ordinary citizens will be able to log in and report events that can then be viewed by researchers, academics and other ordinary citizens. Reports will contain information about the location and time of event, as well as details specific to the type of event.

1.6.2 Generic Event Viewing

Researchers will be able to view event reports in a map representation, with greater event report detail provided below the map. The map will feature pins that show information about the event when hovered over. The detailed list will contain all information about the event reports currently on the map, with an option to show all information in the set of event reports.

1.7 Systems Goals

The goal of this system is to provide a generic crowdsourcing website, that is versatile for any type of data researchers want to research, easy and intuitive enough for any user to report events and view data, and reliable and secure enough for academic use.

1.8 System Overview and Diagram

The webpage will consist of the major components, generic event reporting and generic event viewing. The main page will contain a map and detailed list of events for the selected event set. There will be a button on the main page that will take the user to a reporting interface. See Figure 1.1.

1.9 Technologies Overview

This section contains a list of specific technologies used to develop the system. See Table 1.1.

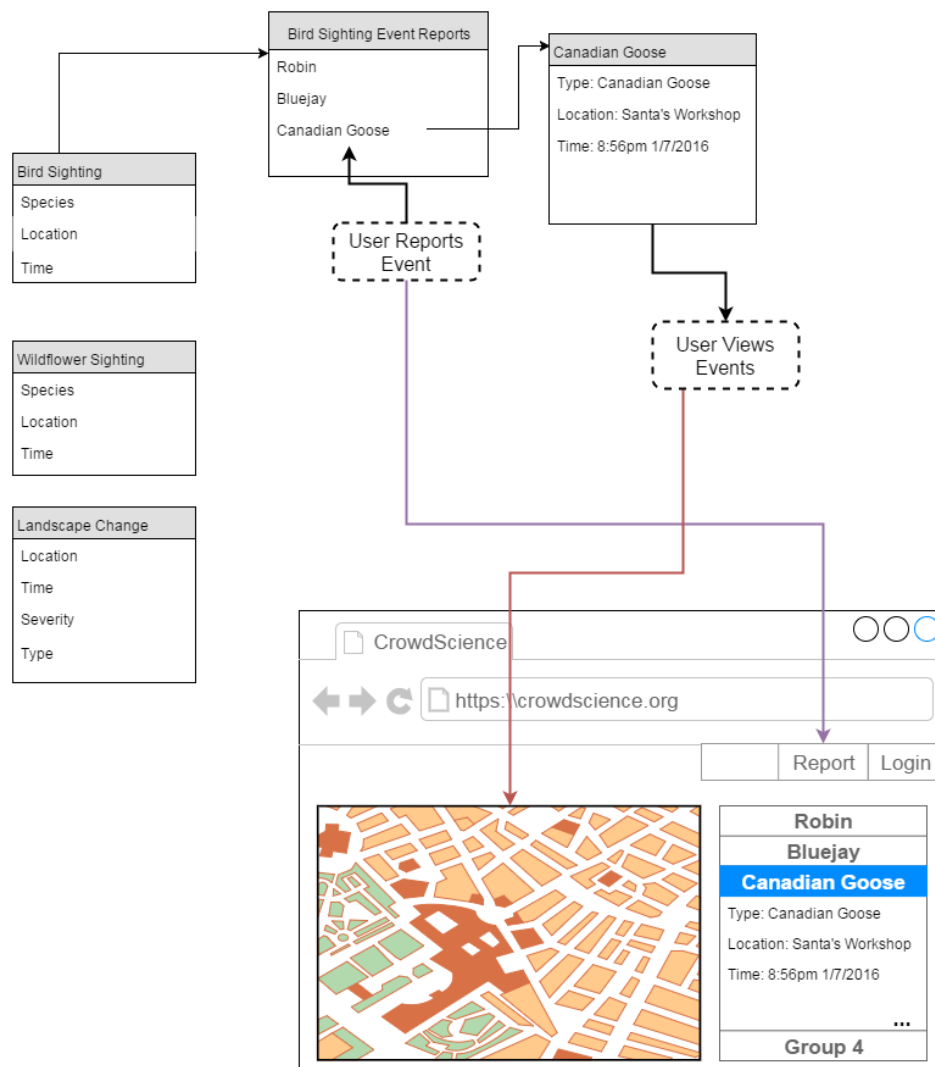


Figure 1.1: Design of Crowd Science Main Page

Table 1.1: Technologies Used

Technology	Description	Reference Material	System Usage
Apache 2.0	Used for website server hosting.	http://httpd.apache.org/docs/2.0/	Used to host Crowd Science Mapper website.
HTML	Hypertext Markup Language, basic webpage scripting language.	http://html.net/	Used to tie together JavaScript, PHP, and CSS webpages.
JavaScript	More advanced language to create more complex objects.	http://html.net/	Used to create more complex objects, such as the event map.
PHP	Hypertext Preprocessor, used with HTML to provide stateful webpages.	http://html.net/	Used to send and receive information from the Mongo Database.
CSS	Cascading Style Sheet, used to create a unified look and feel for websites.	http://html.net/	Used to create look and feel of Crowd Science Mapper.
Mongo Database	Used to store information.	http://www.mongodb.org/	Used to store user login information and event reports.

2

User Stories, Requirements, and Product Backlog

2.1 Overview

This section contains basic requirements for the Crowd Science Mapper project, such as user stories, design constraints, and product backlog.

2.2 User Stories

2.2.1 User Story #1

As a user, I want to be able to view a visual map representation of event reports and a detailed list of event reports.

2.2.2 User Story #2

As a user, I want to be able to register and login and submit an event report.

2.2.3 User Story #3

As a user, I want to be able to select which set of events I would like to view.

2.3 Requirements and Design Constraints

This project will be a HTML based webpage using Java Script to connect to a Mongo database, and hosted on an Apache server.

2.3.1 System Requirements

Webpage should be able to run on all operating systems and all internet browsers. This project is not required to have mobile functionality.

2.3.2 Network Requirements

This project will be server based, hosted on an Apache 2.0 server, access supplied to us by Gail Schmidt. The server is a cloud based server operated by SGT. Information about Apache 2.0 servers can be found here: <http://httpd.apache.org/docs/2.0/>.

2.4 Product Backlog

The product backlog is directly derived from the user stories, but much more refined. Each product backlog item will map directly to test cases in a tracability matrix.

2.4.1 Navigation Bar

- Each page shall contain a navigation bar at the top of the page.
- The navigation bar will have buttons for logging in, new user registration, administration, and event reporting.
- The navigation bar shall contain a drop down box for selecting the event set.
- The selected event set shall maintain its state when navigating to a different page or refreshing the page.

2.4.2 New User Registration

- When no user is logged in, there will be a button on the main page leading to a new user registration page.
- The registration page will have a feild for username, password and password verification, and a "submit" button.
- If the passwords do not match, the user will be notified, and need to reenter one or both passwords.
- After registering, a user will automatically be logged in.

2.4.3 User Login

- When no user is logged in, there will be a button on the main page leading to a login page
- The login page will have fields for entering username and passwords, a "login" button and a link to the user registration page.
- The user will be notified if the username or password was incorrect, and may need to reenter one or both feilds.
- When the user is logged in, an icon indicating the logged in user and a log out button will replace the login button on the navigation page.
- When an administrator logs in, they wil lbe able to see buttons in the navigation bar that lead to pages for editing events and customizing event sets.

2.4.4 Event reporting interface

- When a user is logged in, the user is listed as the author of the report.
- When no user is logged in, the author of the report is "Annonymous".
- Every event report shall include a longitude and latitude feild.
- The event reporting window shall contain the feilds specified for that event data set.
- Each required feild will be marked as required.
- The event reporting window shall contain a submit button.
- The user will be notified if they have not entered all required feilds, and will be able to return to edit their unfinished report.

2.4.5 Detailed event list

- The detailed event list will be a table of the current event set, and will include all feilds specified for that event data set.
- Each entry shall include longitude, latitude of event, and the author of the event.
- When a point on the map is hovered over, the associated entry in the list will be highlighted.
- When a point on the map is clicked, the associated entry in the list will be highlighted in a different shade.

2.4.6 Map representation of events

- The map shall be a visual representation of the event data set.
- The map shall contain a marker for each event report, placed at the longitude and latitude specified in the report.
- The map will be able to be zoomed in, zoomed out, and panned.
- Entries in the event list will be highlighted when a marker is hovered over or clicked.

2.4.7 User selection of data to view

- User will beable to select from a drop down menu on any page which event data set to view.
- When the current event data set is changed, the map, event list, administrator functions and report features will change according to the feilds specified for that set.
- If implemented, the general appearance of the pages will change according to the selected event data set.

3

Project Overview

This section provides information about the team members, team member roles, project management approach and phase overview.

3.1 Team Member's Roles

Currently, Hannah Aker fulfills all team roles. Originally, Hannah Aker was the team leader and scrum master, and Jiasong Yan was a team member, and both were developer and testers.

3.2 Project Management Approach

The project will be managed using an Agile approach. There will be 6 sprints total in this project, each lasting 3 weeks. The project backlog is owned by the team, and located on the team Github repository. All parties have access to the Sprint and Product Backlogs. Github issues will be used to track sprint tasks, bugs or trouble tickets, and user stories. The github repository is located at: <https://github.com/SDSMT-CSC464-F15/crowdscience>

3.3 Stakeholder Information

Stakeholders for this project are academics and researchers who would use the collected data for research and start new data collections, and ordinary citizens who would be the main users, in the field reporting events.

3.3.1 Customer or End User (Product Owner)

Product owners are Dr. Mengyu Qiao and Gail Schmidt, who will assist in the project in mentor roles. As needed, they will assist with prioritizing the product backlog, and identify important features. Dr. Mengyu Qiao's research interest area is closely related to crowdsourcing, and Gail Schmidt was a mentor and sponsor for the original project, the Landscape Change Mapper.

3.3.2 Management or Instructor (Scrum Master)

Originally, the scrum master in this project was Hannah Aker, who conducted sprint meetings and handled most client contact. Currently, there is no need for the role of scrum master to be assigned, Hannah Aker is fulfilling all team roles.

3.3.3 Investors

There are no investors in the project.

3.3.4 Developers –Testers

Originally developers and testers were Jiasong Yan and Hannah Aker. Currently, Hannah Aker fulfills all team roles. When the project is beta tested, testers may include SDSMT faculty and students, with faculty as administrators and students as ordinary users reporting events.

3.4 Budget

There is no budget for this project, no new equipment, software, or liscence need to be purchased for the completion of this project.

3.5 Intellectual Property and Licensing

Intellectual property rights belongs to South Dakota School of Mines and Technology. This project is a proof-of-concept project, and will not need special licensing.

3.6 Terminology and Acronyms

- SGT: Stinger Ghaffarian Technologies
- LCM: Landscape Change Mapper
- HTML: Hyper-Text Markup Language
- CSS: Cascading Style Sheet
- PHP: Hypertext Preprocessor

3.7 Phase Overview

This project will be implemented in two phases. The first phase will entail analyzing the Landscape Change Mapper project and adapting a copy of the project for expansion into the generic Crowd Science Mapper. The second phase will entail adding the necessary freatures to the base project from phase one to create a proof of concept website.

Within phase one, we will implement and then test the adapted Landscape Change Mapper features we add to the project. Delivery is incorporated into the testing phase, because all testing will be done on the live server. Phase two will consist of all the steps in phase one, but will also include a design phase where we fully design the new features to be added.

3.8 Sprint Schedule

There will be 6 sprints, each lasting 3 weeks. The start and end dates for each sprint are listed below.

- Sprint 1: 9/14/15 - 10/2/15
- Sprint 2: 10/12/15 - 10/30/15
- Sprint 3: 11/9/15 - 11/27/15
- Sprint 4: 1/18/16 - 2/5/16
- Sprint 5: 2/15/16 - 3/4/16
- Sprint 6: 3/21/16 - 4/15/16

3.9 Timeline

See Figure 3.1.

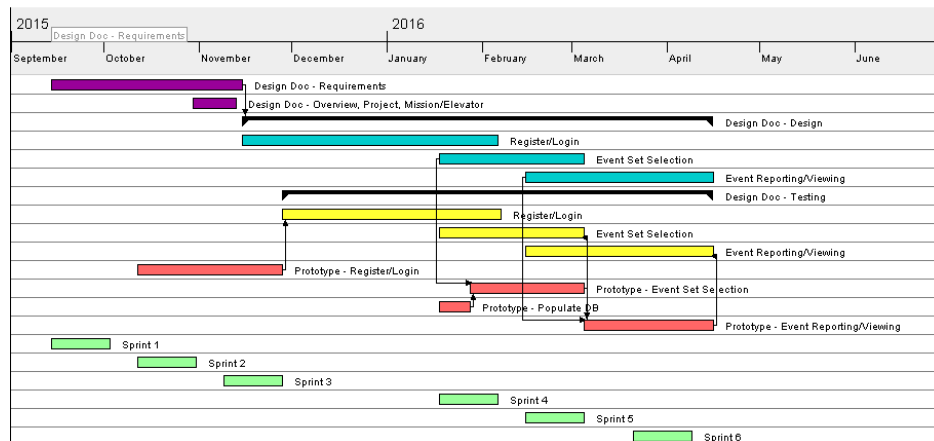


Figure 3.1: Gantt Chart of Project Completion Schedule

3.10 Backlogs

3.10.1 Sprint 1 Backlog

- Documentation: start requirements section.
- Review code from Landscape Change Mapper project.

3.10.2 Sprint 2 Backlog

- Documentation: requirements section, start project, overview and mission/elevator sections.
- Implement Login/Register interface.
- Prepare for first client presentation

3.10.3 Sprint 3 Backlog

- Documentation: project, overview and mission/elevator sections, start design and testing section for login/register.
- Finish and test Login/Register interface.
- Polish design document for first semester review.

3.10.4 Sprint 4 Backlog

- Documentation: prototype sections, revise requirements, design and testing section for login/register, start design section for set selection/list, and revised sprint plan in overview.
- Add sample event reports and sample event set data to database. There will be a collection for each event set, one for information about the event set, and one for user login information.
- Implement a select box to choose a different event set, and verify that the connection to the database is working as expected. The event report list will be started to verify accuracy of database.

3.10.5 Sprint 5 Backlog

- Documentation: design and testing section for set selection/list, start design section for report and map.
- Implement reporting interface.

- Finish implementing event report list.
- Implement map interface.

3.10.6 Sprint 6 Backlog

- Finish Documentation: design and testing for report and map features, finalize sprint prototype and sprint report sections.
- Final testing and debugging.
- Polish prototype.
- Design Fair preparation.

3.11 Development Environment

This section has information required to setup a development environment to run, test, and/or develop.

3.11.1 Development IDE and Tools

No development IDEs were used. Code editing was done in a plaintext editor, Notepad++. More information about Notepad++ can be found at <https://notepad-plus-plus.org/>.

3.11.2 Source Control

Source control is Github; github issues will be used to keep track of backlog and sprint status. The github repository is located at: <https://github.com/SDSMT-CSC464-F15/crowdscience> All parties have access to the Sprint and Product Backlogs.

3.11.3 Dependencies

The server requires Apache 2.2 and Mongo DB version 2.4.9 installed to run the project.

3.11.4 Build Environment

The code in this project does not need to be built. The project uses scripted languages, which do not need compilation or building.

3.11.5 Development Machine Setup

A remote desktop connection is required to connect to the server hosting the code. The rdp file for this remote desktop connection is show in Algorithm 1. The development machine should also install a plaintext editor such as Notepad++ to view and edit project files.

Algorithm 1 Remote Desktop Connection (.rdp) file

```
auto connect:i:1
full address:s:52.23.113.55
username:s:lcmapper
password:s:jP\%7Fen\%JK
```

4

Project Revisions

This chapter includes information about the project revisions made regarding the removal of Jiasong Yan from the project in January 2016. Major content changes are listed here, other minor changes are noted in the rest of the document.

4.1 Overview and Concept of Operations

Team member revisions are noted in the “Team Members and Team Name” section. Figure ?? was replaced with Figure 1.1. The “Event Set Editing” subsection in the Major Components Section was removed. The remainder of the chapter was similarly revised to exclude this subsection.

4.1.1 Event Set Editing

Administrators can edit existing events sets to refine what users report, and create new event sets to allow users to start reporting events. Administrators will be able to moderate the events that users report.

4.2 User Stories, Requirements, and Product Backlog

User Stories #4 and #5 were removed from this chapter. Subsections “Administrator editing of existing events” and “Administrator customization of event sets” were removed from the Product Backlog section.

4.2.1 User Story #4

As an administrator, I want to be able to customize a set of events to fit my needs. This may include user input and display items, database design, digital map, webpage color and style, logo, etc.

4.2.2 User Story #5

As an administrator, I want to be able to edit existing event reports.

4.2.3 Administrator editing of existing events

- The detailed data list shall be displayed in a seperate window.
- Each event report in the list will have an “edit” button.
- When an administrator clicks the “edit” button, they will be taken to the event reporting interface, with the added feild “Reason for editing”.
- When an administrator edits an event report, the administrator name, reason for editing, and date and time shall be recorded and added to the event’s history.

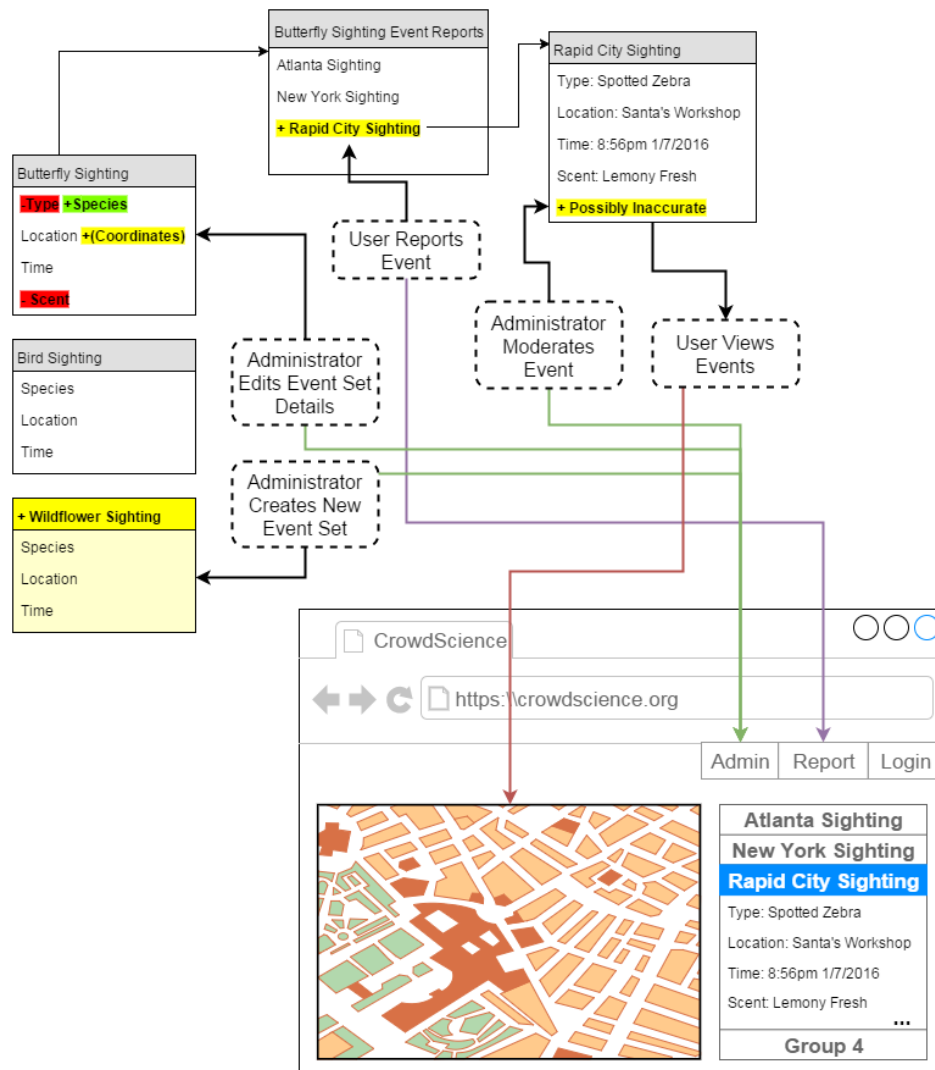


Figure 4.1: Design of Crowd Science Main Page

- An administrator may mark an event report as false, the administrator name, reason for declaring false, and date and time shall be added to the event's history.

4.2.4 Administrator customization of event sets

- The administrator will be able to create a new event data set.
- The administrator will be able to edit the details of an existing event data set.
- When the administrator clicks on the new event data set, a blank event data set will be created.
- The display name and identification name of an event data set cannot be empty or null.
- The identification name will be used to reference the database, and cannot be changed after creation.
- The administrator will be able to add fields to their event data set by clicking an "Add new Field" button.
- The administrator will be able to designate the field identification name, display name, data type, display method if applicable, and acceptable values if applicable.

- If the administrator wants to change the data type of the feild, they will need to remove the current feild and recreate it with the new data type, and data stored in the previous type will be lost.
- The administrator will be able to edit display name, display method, and acceptable values with ease.
- The data types that can be selected will be number, short text, long text, radio button group, check box group, and picture upload.
- When the administrator is finished editing or creating their event data set, they will be able to click “save” to save their data.
- If there are problems with what the administrator has entered, the administrator will be notified and prompted to fix the errors.

4.3 Project Overview

Team Member Roles were revised to reflect the team member removal. Timeline and Sprint Backlogs were revised to reflect the revised requirements and timeline.

5

Design and Implementation

This section is used to describe the design details for each of the major components in the system. Note that this chapter is critical for all tracks. Research tracks would do experimental design here where other tracks would include the engineering design aspects. This section is not brief and requires the necessary detail that can be used by the reader to truly understand the architecture and implementation details without having to dig into the code.

5.1 Architecture and System Design

This is where you will place the overall system design or the architecture. This section should be image rich. There is the old phrase *a picture is worth a thousand words*, in this class it could be worth a hundred points (well if you sum up over the entire team). One needs to enter the design and why a particular design has been done.

5.1.1 Design Selection

Failed designs, design ideas, rejected designs here.

5.1.2 Data Structures and Algorithms

Describe the special data structures and any special algorithms.

5.1.3 Data Flow

5.1.4 Communications

5.1.5 Classes

5.1.6 UML

5.1.7 GUI

5.1.8 MVVM, etc

5.2 Major Component #1

5.2.1 Technologies Used

This section provides a list of technologies used for this component. The details for the technologies have already been provided in the Overview section.

5.2.2 Component Overview

This section can take the form of a list of features.

5.2.3 Phase Overview

This is an extension of the Phase Overview above, but specific to this component. It is meant to be basically a brief list with space for marking the phase status.

5.2.4 Architecture Diagram

It is important to build and maintain an architecture diagram. However, it may be that a component is best described visually with a data flow diagram.

5.2.5 Data Flow Diagram

It is important to build and maintain a data flow diagram. However, it may be that a component is best described visually with an architecture diagram.

5.2.6 Design Details

This is where the details are presented and may contain subsections. Here is an example code listing:

```
#include <stdio.h>
#define N 10
/* Block
 * comment */

int main()
{
    int i;

    // Line comment.
    puts("Hello world!");

    for (i = 0; i < N; i++)
    {
        puts("LaTeX is also great for programmers!");
    }

    return 0;
}
```

This code listing is not floating or automatically numbered. If you want auto-numbering, put it in the algorithm environment (not algorithmic however) shown above.

6

System and Unit Testing

This section describes the approach taken with regard to system and unit testing.

6.1 Overview

Provides a brief overview of the testing approach, testing frameworks, and general how testing is/will be done to provide a measure of success for the system.

Each requirement (user story component) should be tested. A review of objectives and constraints might be needed here.

6.2 Dependencies

Describe the basic dependencies which should include unit testing frameworks and reference material.

6.3 Test Setup and Execution

Describe how test cases were developed, setup, and executed. This section can be extremely involved if a complete list of test cases was warranted for the system. One approach is to list each requirement, module, or component and describe the test.

The unit tests are described here.

6.4 System Testing

6.5 System Integration Analysis

6.6 Risk Analysis

6.6.1 Risk Mitigation

6.7 Successes, Issues and Problems

6.7.1 Changes to the Backlog

7

Prototypes

This chapter is for recording each prototype developed. It is a historical record of what you accomplished in 464/465. This should be organized according to Sprints. It should have the basic description of the sprint deliverable and what was accomplished. Screen shots, photos, captures from video, etc should be used.

7.1 Sprint 1 Prototype

7.1.1 Deliverable

Rough draft of main page. See Figure 7.1.

7.1.2 Backlog

The backlog completed for this sprint was initial documentation, primarily including the requirements section of the design document; an analysis of the work done in the previous project, the Landscape Change Mapper; and creating a rough draft of the Crowd Science Mapper website.

7.1.3 Success/Fail

This sprint was a success, overall. No major issues arose.

7.2 Sprint 2 Prototype

7.2.1 Deliverable

Updated main page, added login and register features. See Figure 7.2, Figure 7.3, and Figure 7.4.

7.2.2 Backlog

The backlog completed for this sprint was a completed analysis of original project, the LCM; expansion on the original draft to include login and register page layouts; transporting code from LCM project for login and register pages and adapting the code for our project; and more work on the requirements, project, and mission/elevator sections.

7.2.3 Success/Fail

This sprint was a success, overall. No major issues arose.

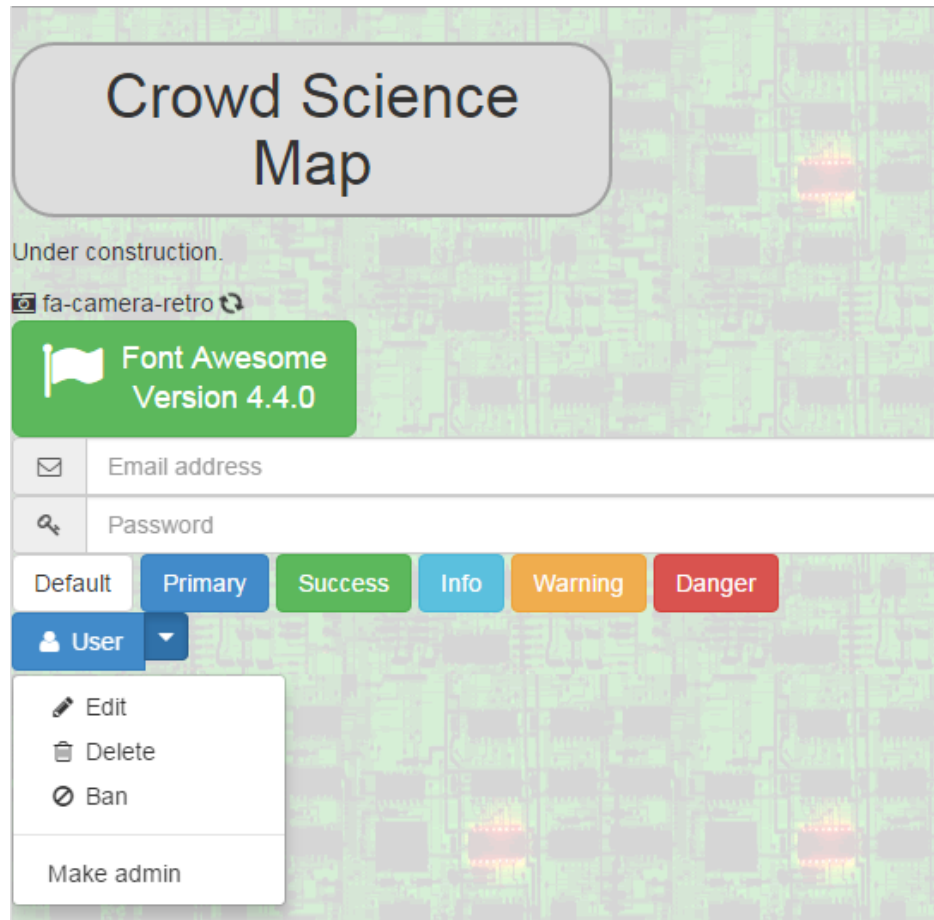


Figure 7.1: Crowd Science Main Page Prototype as of Sprint 1

7.3 Sprint 3 Prototype

7.3.1 Deliverable

There were no changes to the deliverable of Sprint 2.

7.3.2 Backlog

The backlog completed for this sprint was work on the requirements section and overview section.

7.3.3 Success/Fail

This sprint was a roaring failure, overall. Following the client presentation on 10/27/2015, Jiasong entirely ceased contributing to the project and attending team meetings. The features planned to be added to the prototype, submitting a report and viewing a list of reports; were not added to the prototype.

7.4 Sprint 4 Prototype

7.4.1 Deliverable

Added event set selection to main page, added feilds to register page. See Figure 7.5, Figure 7.8, Figure 7.7 , and Figure 7.6.

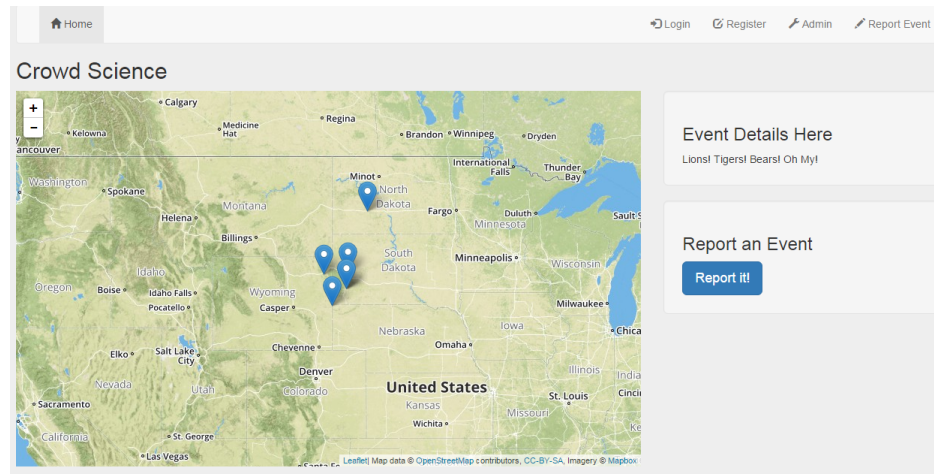


Figure 7.2: Crowd Science Main Page Prototype as of Sprint 2

7.4.2 Backlog

Backlog completed this sprint was a revision of of project requirements, deliverables, project overview, and team information; the addition of several collections to the database, to contain event reports, user information, and event report set information; and the implementation of a selection box to switch between event report sets.

7.4.3 Success/Fail

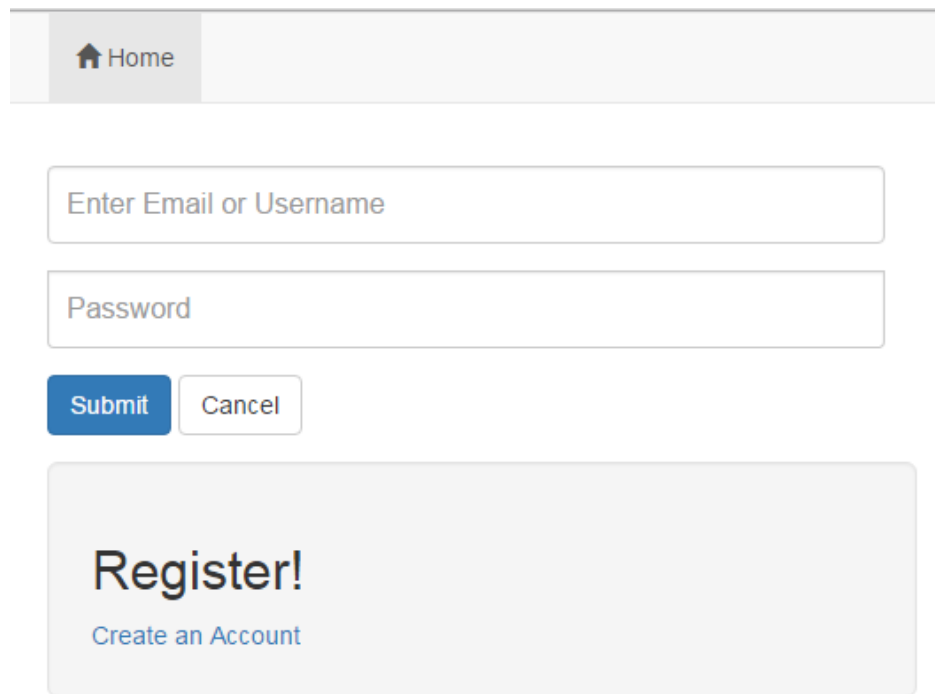
This sprint was a roaring success, overall. Early in the sprint, Jiasong Yan was removed from the team, and the project was adjusted accordingly. Project revisions went smoothly, and two major components added to the prototype.

7.5 Sprint 5 Prototype

7.5.1 Deliverable

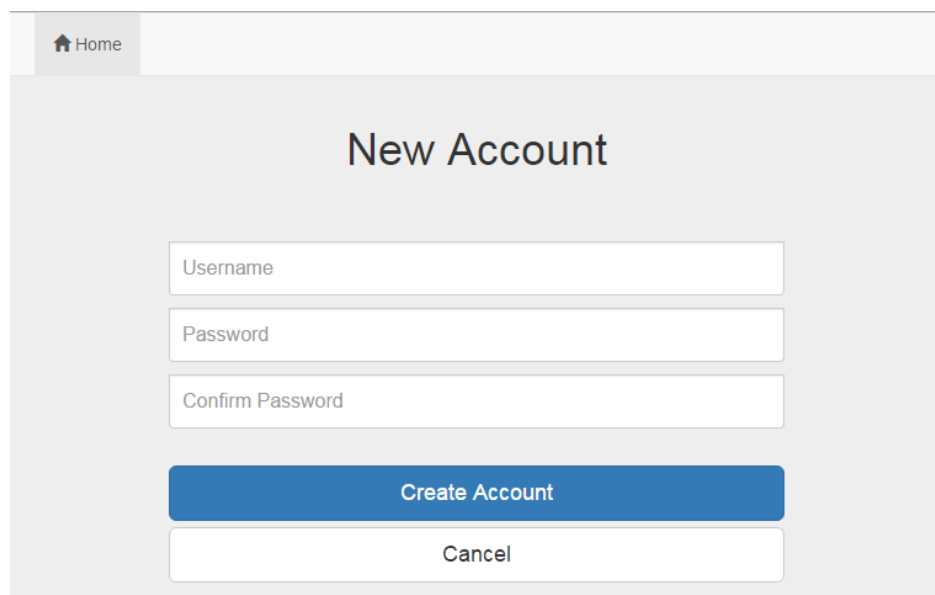
7.5.2 Backlog

7.5.3 Success/Fail



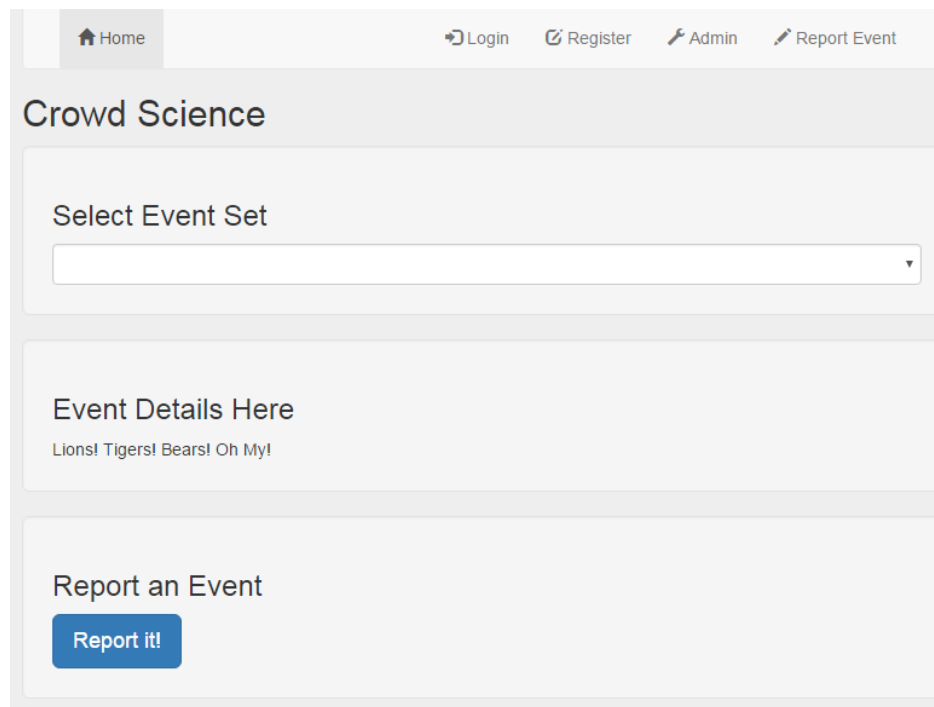
A prototype of a login page. At the top, there is a navigation bar with a 'Home' link and a house icon. Below the navigation bar, there are two input fields: 'Enter Email or Username' and 'Password'. Below these fields are two buttons: 'Submit' (blue) and 'Cancel' (white). At the bottom, there is a light gray box containing the text 'Register!' in a large font, followed by a link 'Create an Account' in blue text.

Figure 7.3: Crowd Science Login Page Prototype as of Sprint 2



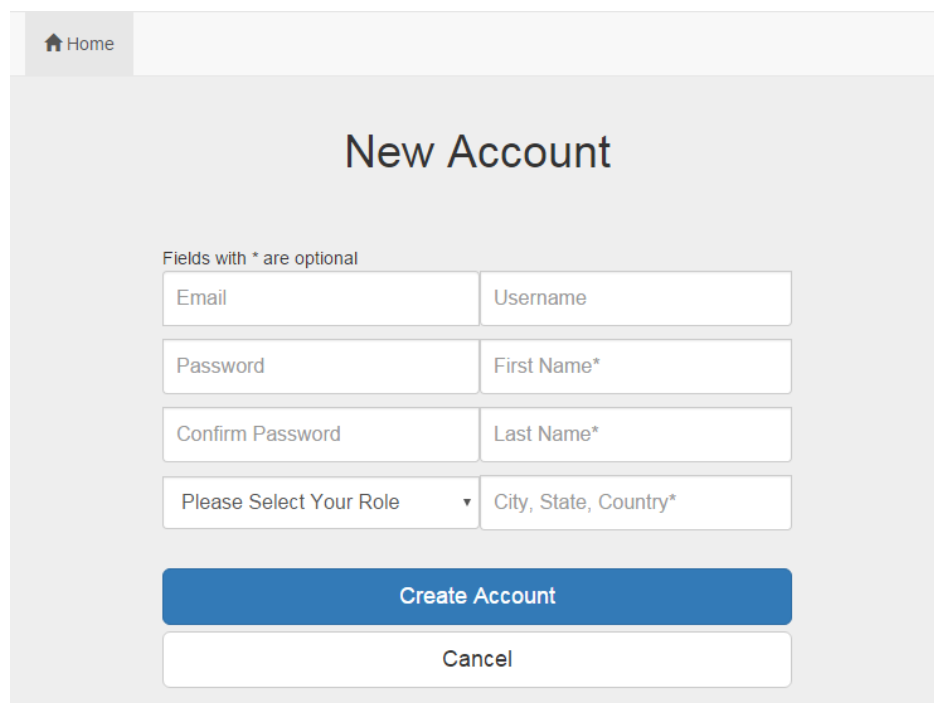
A prototype of a register page. At the top, there is a navigation bar with a 'Home' link and a house icon. Below the navigation bar, the page has a light gray background with the title 'New Account' in a large font. Below the title, there are three input fields: 'Username', 'Password', and 'Confirm Password'. Below these fields are two buttons: 'Create Account' (blue) and 'Cancel' (white).

Figure 7.4: Crowd Science Register Page Prototype as of Sprint 2



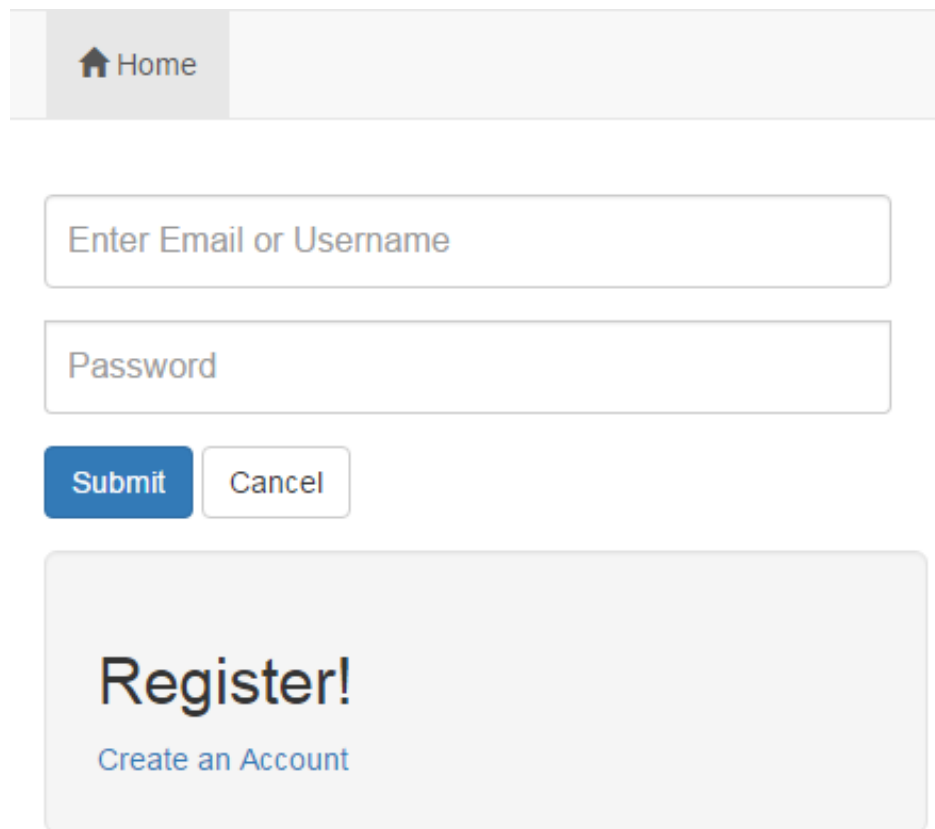
The image shows a web page prototype for 'Crowd Science'. At the top, there is a navigation bar with a 'Home' link (house icon) and four action links: 'Login' (key icon), 'Register' (pencil icon), 'Admin' (wrench icon), and 'Report Event' (pencil icon). Below the navigation bar, the main content area has a title 'Crowd Science'. Underneath the title is a section titled 'Select Event Set' with a dropdown menu. Below that is a section titled 'Event Details Here' with the text 'Lions! Tigers! Bears! Oh My!'. At the bottom is a section titled 'Report an Event' with a blue button labeled 'Report it!'.

Figure 7.5: Crowd Science Main Page Prototype as of Sprint 4



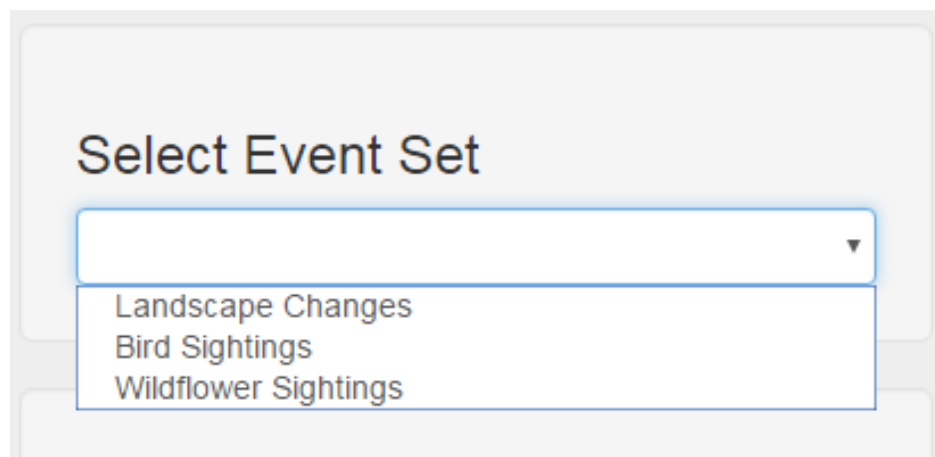
The image shows a web page prototype for 'New Account'. At the top, there is a navigation bar with a 'Home' link (house icon). Below the navigation bar, the main content area has a title 'New Account'. Underneath the title is a section titled 'Fields with * are optional'. Below this section are eight input fields arranged in two columns. The first column contains 'Email', 'Password', 'Confirm Password', and 'Please Select Your Role' (a dropdown menu). The second column contains 'Username', 'First Name*', 'Last Name*', and 'City, State, Country*'. Below the input fields are two buttons: a blue button labeled 'Create Account' and a white button labeled 'Cancel'.

Figure 7.6: Crowd Science Register Page Prototype as of Sprint 4



A prototype of a login page. At the top, there is a navigation bar with a 'Home' link accompanied by a house icon. Below this, there are two input fields: 'Enter Email or Username' and 'Password'. Under the input fields are two buttons: a blue 'Submit' button and a white 'Cancel' button. Below the buttons is a large light gray box containing the text 'Register!' in a large, bold font, and a blue link 'Create an Account' below it.

Figure 7.7: Crowd Science Login Page Prototype as of Sprint 4



A prototype of an event set selection interface. It features a title 'Select Event Set' in a large, bold font. Below the title is a dropdown menu. The dropdown is currently open, showing three options: 'Landscape Changes', 'Bird Sightings', and 'Wildflower Sightings'. A small downward-pointing triangle is visible in the top right corner of the dropdown box.

Figure 7.8: Crowd Science Event Set Selection Prototype as of Sprint 4

SDSMT SENIOR DESIGN SOFTWARE DEVELOPMENT AGREEMENT

This Software Development Agreement (the "Agreement") is made between the SDSMT Computer Science Senior Design Team "Crowd Science Mapper", consisting of team members Hannah Aker and Jiasong Yan, and Sponsors Dr. Mengyu Qiao and Gail Schmidt, with address: 501 E. Saint Joseph Street, Rapid City, SD, 57701.

1 RECITALS

1. Sponsor desires Senior Design Team to develop a set of generic crowdsourcing system framework and toolkits, which can be customized by ordinary users with no programming experience using graphical user interface.
2. Senior Design Teams willing to develop such Software.

NOW, THEREFORE, in consideration of the mutual covenants and promises herein contained, the Team and Sponsor agree as follows:

2 EFFECTIVE DATE

This Agreement shall be effective as of September 14, 2015.

3 DEFINITIONS

1. "Software" shall mean the computer programs in machine readable object code form and any subsequent error corrections or updates supplied to Sponsor by Senior Design Team pursuant to this Agreement.

4 DEVELOPMENT OF SOFTWARE

1. Senior Design Team will use its best efforts to develop the Software described in the Crowd Science Mapper project description. The Software development will be under the direction of or his/her successors as mutually agreed to by the parties ("Team Lead") and will be conducted by the Team Lead. The Team will deliver the Software to the satisfaction of the course instructor that reasonable effort has been made to address the needs of the client. The Team understands that failure to deliver the Software is grounds for failing the course.
2. Sponsor understands that the Senior Design course's mission is education and advancement of knowledge, and, consequently, the development of Software must further that mission. The Senior Design Course does not guarantee specific results or any results, and the Software will be developed only on a best efforts basis. The Software is considered PROOF OF CONCEPT only and is NOT intended for commercial, medical, mission critical or industrial applications.
3. The Senior Design instructor will act as mediator between Sponsor and Team; and resolve any conflicts that may arise.

5 COMPENSATION

No Compensation

6 CONSULTATION AND REPORTS

1. Sponsor's designated representative for consultation and communications with the Team Lead shall be Dr. Mengyu Qiao or such other person as Sponsor may from time to time designate to the Team Lead ("Designated Representative").
2. During the Term of the Agreement, Sponsor's representatives may consult informally with course instructor regarding the project, both personally and by telephone. Access to work carried on in University facilities, if any, in the course of this Agreement shall be entirely under the control of University personnel but shall be made available on a reasonable basis.
3. The Team Lead will submit written progress reports. At the conclusion of this Agreement, the Team Lead shall submit a comprehensive final report in the form of the formal course documentation at the conclusion of the Senior Design II course.

7 CONFIDENTIAL INFORMATION

1. The parties may wish, from time to time, in connection with work contemplated under this Agreement, to disclose confidential information to each other ("Confidential Information"). Each party will use reasonable efforts to prevent the disclosure of any of the other party's Confidential Information to third parties for a period of three (3) years after the termination of this Agreement, provided that the recipient party's obligation shall not apply to information that:
 - (a) is not disclosed in writing or reduced to writing and so marked with an appropriate confidentiality legend within thirty (30) days of disclosure;
 - (b) is already in the recipient party's possession at the time of disclosure thereof;
 - (c) is or later becomes part of the public domain through no fault of the recipient party;
 - (d) is received from a third party having no obligations of confidentiality to the disclosing party;
 - (e) is independently developed by the recipient party; or
 - (f) is required by law or regulation to be disclosed.
2. In the event that information is required to be disclosed pursuant to subsection (6), the party required to make disclosure shall notify the other to allow that party to assert whatever exclusions or exemptions may be available to it under such law or regulation.

8 INTELLECTUAL PROPERTY RIGHTS

All deliverables become property of South Dakota School of Mines and Technology.

9 WARRANTIES

The Senior Design Team represents and warrants to Sponsor that:

1. the Software is the original work of the Senior Design Team in each and all aspects;
2. the Software and its use do not infringe any copyright or trade secret rights of any third party.

No agreements will be made beyond items (1) and (2).

10 INDEMNITY

1. Sponsor is responsible for claims and damages, losses or expenses held against the Sponsor.
2. Sponsor shall indemnify and hold harmless the Senior Design Team, its affiliated companies and the officers, agents, directors and employees of the same from any and all claims and damages, losses or expenses, including attorney's fees, caused by any negligent act of Sponsor or any of Sponsor's agents, employees, subcontractors, or suppliers.
3. NEITHER PARTY TO THIS AGREEMENT NOR THEIR AFFILIATED COMPANIES, NOR THE OFFICERS, AGENTS, STUDENTS AND EMPLOYEES OF ANY OF THE FOREGOING, SHALL BE LIABLE TO ANY OTHER PARTY HERETO IN ANY ACTION OR CLAIM FOR CONSEQUENTIAL OR SPECIAL DAMAGES, LOSS OF PROFITS, LOSS OF OPPORTUNITY, LOSS OF PRODUCT OR LOSS OF USE, WHETHER THE ACTION IN WHICH RECOVERY OF DAMAGES IS SOUGHT IS BASED ON CONTRACT TORT (INCLUDING SOLE, CONCURRENT OR OTHER NEGLIGENCE AND STRICT LIABILITY), STATUTE OR OTHERWISE. TO THE EXTENT PERMITTED BY LAW, ANY STATUTORY REMEDIES WHICH ARE INCONSISTENT WITH THE PROVISIONS OF THESE TERMS ARE WAIVED.

11 INDEPENDENT CONTRACTOR

For the purposes of this Agreement and all services to be provided hereunder, the parties shall be, and shall be deemed to be, independent contractors and not agents or employees of the other party. Neither party shall have authority to make any statements, representations or commitments of any kind, or to take any action which shall be binding on the other party, except as may be expressly provided for herein or authorized in writing.

12 TERM AND TERMINATION

1. This Agreement shall commence on the Effective Date and extend until the end of classes of the second semester of Senior Design (CSC 465), unless sooner terminated in accordance with the provisions of this Section ("Term").
2. This Agreement may be terminated by the written agreement of both parties.
3. In the event that either party shall be in default of its materials obligations under this Agreement and shall fail to remedy such default within thirty (30) days after receipt of written notice thereof, this Agreement shall terminate upon expiration of the thirty (30) day period.
4. Any provisions of this Agreement which by their nature extend beyond termination shall survive such termination.

13 ATTACHMENTS

Attachment "Crowd Science Mapper Project Description" is incorporated in this Agreement.

14 GENERAL

1. This Agreement constitutes the entire and only agreement between the parties relating to the Senior Design Course, and all prior negotiations, representations, agreements and understandings are superseded hereby.

No agreements altering or supplementing the terms hereof may be made except by means of a written document signed by the duly authorized representatives of the parties.

2. This Agreement shall be governed by, construed, and enforced in accordance with the internal laws of the State of South Dakota.

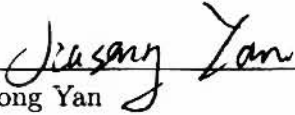
15 SIGNATURES



Hannah Aker

9/24/2015

Date



Jiasong Yan

9/29/2015


Date



Dr. Megua Qiao

9/25/2015

Date



Gail Schmidt

9/25/2015

Date

A

Product Description

1 Project Title

Crowd Science Mapper

2 Proposed/Advised by

Dr. Mengyu Qiao

3 Project Description

Crowd Science (also known as Citizen Science) aims at soliciting ideas, findings, and information to support scientific research, which could reduce time and cost for data acquisition and enhance the accuracy and generality of research results. Inspired by USGS Did You Feel It (DYFI) project, USGS Butterflies and Moths of North America (BAMONA) project, and Cornell's eBird project, a group of professors and students from SDSMT partnered with SGT, Inc. to develop a Landscape Change Mapper (LC Mapper) system, which provides a mechanism for citizens and scientists to identify and track landscape change, thus extending the observational resources available to scientists and deepening the awareness and understanding of ecological issues by the public participants.

In recognition of the growing demand for crowdsourcing in scientific research and the commonalities in various websites relying on citizens to assist in tracking and reporting science as it is happening, it will be helpful to develop a set of generic crowdsourcing system framework and toolkits, which can be customized by ordinary users with no programming experience using graphical user interface. The configurable features of the framework may include user input and display items, database design, digital map, webpage color and style, logo, etc.

The Crowd Science Mapper will be a proof-of-concept project which spans across the areas of GIS/geospatial, cloud, crowd sourcing, citizen science, mobile applications, agile development, open source software, and open source data. The expected product comprises three components: 1) a configurable website that allows public participants to report and view events with visual help of a digital map; 2) a configurable mobile application with the same core features of the public website; 3) an administration website that allows administrators to customize and modify the public system design using graphical user interface, and allows scientists and moderators to control and analyze users' reports.

4 Useful Links

USGS Did You Feel It website: <http://earthquake.usgs.gov/earthquakes/dyfi> USGS Butterflies and Moths of North America website: <http://www.butterfliesandmoths.org> Cornell's eBird website: <http://ebird.org/content/ebird> SDSMT-SGT Landscape Change Mapper website: <http://54.244.242.86/>

5 Project Duration

Two semesters.

6 Technical Areas Encompassed

Web development, Database, Mobile development

7 Number of Students/Disciplines required

4 Computer Science

B

Sprint Reports

1 Sprint Report #1

1.1 Team Members

Hannah Aker and Jiasong Yan

1.2 Project Sponsors

Dr. Mengyu Qiao and Gail Schmidt

1.3 Sponsor/User Description

1.3.a User Description

Primary users will be the everyday citizen, interested in reporting some event, such as butterfly sighting, geological or landscape changes, etc. Secondary users will be academics and researchers who will use the gathered information in their research, they will be administrators of this data.

1.3.b Project Goal

The goal of this project to improve on the idea originally presented in the Landscape Change Mapper, and expand on it to create a flexible interface for other kinds of events.

1.3.c User Needs

Primary users need all the core functionality of the Landscape Change Mapper to be maintained. These functions include, but are not limited to:

- Visual map representation of events
- Detailed event list
- Event reporting interface
- New user registration
- User login

Users also need to be able to select which set of events they would like to view. Administrators need to be able to customize a set of events to fit my needs. This may include user input and display items, database design, digital map, webpage color and style, logo, etc. Administrators will also need to be able to edit existing event reports.

1.4 Project Overview

The Crowd Science Mapper will be a generic crowdsourcing system framework and toolkits, which can be customized by ordinary users with no programming experience using graphical user interface

1.5 Project Environment

1.5.a Project Boundaries

While the previous project included a mobile application, this project will not because the team is smaller. This project will be solely web-based.

1.5.b Project Context

This project will use the same general context that the Landscape Change Mapper used.

1.5.c Technical Environment

This project will use the same environment used in the Landscape Change Mapper. This will use HTML, PHP and Java Script to connect to a Mongo Database, and was hosted on an Apache 2.2 Server.

1.5.d Current systems overview

The Landscape Change Mapper webpages used HTML, PHP and Java Script to connect to a Mongo Database, and was hosted on an Apache 2.2 Server. The webpage contained a map of events, detailed event list, event reporting interface, user login, and new user registration. The project included a mobile app with an event reporting interface.

1.6 Project Deliverables

The project deliverable will be a proof-of-concept webpage with the features listed in the backlog.

1.7 Backlog

The following features need to be added to this project:

- Visual map representation of events
- Detailed event list
- Event reporting interface
- New user registration
- User login
- User selection of data set to view
- Administrator login
- Administrator customization of event sets, including user input and display items, database design, digital map, webpage color and style, logo, etc.
- Administrator editing of existing event reports

1.8 Potential Issues

Potential issues might stem from using Java Script to interface with the Mongo DB. We don't have much prior experience with these specific tools, though we have used similar tools.

2 Sprint Report #2

This report will cover the backlog items completed in Sprint 2, the current prototype's features, and team meeting summaries.

2.1 Backlog Completed

We completed our initial analysis of the previous project, the Landscape Change Mapper. Jiasong expanded upon our initial prototype to include layouts for the login, register, and administration webpages. After that was completed, Hannah worked on transporting code for the register and login functions from the old project LCM. This was then lightly tested, and functioned similarly to the same functions on the LCM project. More extensive testing will take place in Sprint 3. Hannah continued to expand on the requirements section, fully defining the exact requirements for the login and register pages. In the documentation, the project and mission/elevator sections were completed.

2.2 Prototype Features

The prototype now has features that allow a user to register for a new account or log in with their current account. The look and feel of the prototype were also updated to resemble the original LCM project.

2.3 Meetings

- 10/15: hour long meeting, discussed Sprint 2 backlog, started compiling the sprint 1 review presentation, worked on transporting functionality from LCM to our project, discovered that the cloud server had been shut down
- 10/22: hour long meeting, finalized presentation, continued work on transporting functionality from LCM to our project

2.4 Client Communication

- 10/15: Hannah emailed Gail and Dr. Qiao concerning the connection issues with the server. Gail was able to communicate with the cloud host administrator to get the cloud server back up and running. The IP address of the server had changed in the restarting of the server, and the Apache 2.0 server had to be restarted. The server is now running smoothly.
- 10/27: presented sprint 1 review presentation to Dr. Qiao, some feedback regarding testing. We plan to implement a traceability matrix.

2.5 Sprint 3 Backlog

In sprint 3, we need to finish the requirements, overview and design sections of the design document. We intend to add features to the prototype to allow the user to submit an event report and view a detailed list of event reports. If everything goes smoothly, we intend to also add the event map feature to the prototype.

3 Sprint Report #3

This report will cover the backlog items completed in Sprint 3, the current prototype's features, and team meeting summaries.

3.1 Backlog Completed

I expanded upon the requirements section in the design document, and finished that section. The overview section was completed, and the design section of the document was started. My resume was also added to the resume appendix.

3.2 Prototype Features

The prototype has no new features.

3.3 Meetings

There are no meetings to report in this sprint.

3.4 Client Communication

- 11/9: The server was move to a new host, Gail emailed to confirm that the team still had full access to the server in its new location.
- 12/1: Confirmed Sprint 3 review presentation time with client.

3.5 Sprint 4 Backlog

In sprint 4, we need to finish the design section of the design document. We intend to add features to the prototype to allow the user to submit an event report and view a detailed list of event reports. If everything goes smoothly, we intend to also add the event map feature to the prototype.

3.6 Sprint 3 Issues

Jiasong failed to attend meetings and failed to work on any features. This has resulted in major setbacks in the project.

4 Sprint Report #4

This report will cover the backlog items completed in Sprint 4, the current prototype's features, and client communication summaries.

4.1 Backlog Completed

- Documentation: revise requirements, project overview, sprint plan, deliverables, and team information
- Add sample event reports and sample event set data to database (There will be a collection (similar to a table in relational databases) for each event set, one for information about the event set (such as field name, type, restrictions, and maybe even background color/image), and one for user login information)
- Implement a select box to choose a different event set, and verify that the connection to the database is working as expected.

4.2 Prototype Features

Expanded register screen to include several new fields: email, first name, last name, role, and city, state, and country. Added selection box for selecting an event set to view. The selection box references a newly created collection in the database, Event Set Information (eventsetsinfo), which contains information about the event report collections in the database. Added sample event report collections to database: Landscape Changes (landscapechange), Bird Sightings (bird), and Wildflower Sightings (wildflower).

4.3 Client Communication

- 1/20/2016: Met with Dr. Qiao to discuss deliverable revisions and backlog revisions, listed below.
- 1/22/2016: Sent email with revised deliverables and sprint schedule to clients.

4.4 Revised Deliverables

Already implemented are login and register features. The minimum viable product includes functionality to select a set of event reports (like birds, butterflies, etc.); and an event reporting interface and map and list event report display whose values and fields update/change to match the currently selected set of event reports. There will be a section in the design document about additional features that could be implemented in a continuation of the project. This section will include an overview of administrative features (such as a user interface for creating and modifying a set of event reports, and moderating submitted reports) and additional tools for viewing event reports (like sorting, filtering, and searching reports).

4.5 Sprint 5 Backlog

- Outstanding Documentation: prototype sections, design and testing section for login/register, and start design section for set selection/list
- Documentation: design and testing section for set selection/list, start design section for report and map
- Implement reporting interface
- Implement event report list
- Implement map interface

4.6 Sprint 6 Backlog

- Finish Documentation: design and testing for report and map features, finalize sprint prototype and sprint report sections
- Final testing (and debugging)
- Polish prototype
- Design Fair preparation

4.7 Sprint 4 Successes/Issues

Jiasong Yan was removed from the project, and necessary revisions to project scope, deliverables and backlog were made. Further details regarding project revision in accordance with Jiasong's removal can be found in the design document.

C

Industrial Experience and Resumes

1 ABET: Industrial Experience Reports

1.1 Hannah Aker

AFMC-OCALC, 76th SMXG, 555th MXDED SMART Intern Summer 2014, Summer 2015 Oklahoma City, OK

- Designed and implemented software tool to view and edit aircraft engine data files for use in developing and testing CETADS (Comprehensive Engine Trending and Diagnostics System), using C#, Windows Forms, WPF, XAML, and MVVM architecture.
- Summer 2014: created proof of concept program with complete functionality in Windows Forms, and created test cases for CETADS by hand using a hex editor.
- Summer 2015: improved original program using WPF, XAML, and MVVM structure, then recreated the program for a different engine.
- Supervisor: Francesco Whittenberger, francesco.whittenberger@us.af.mil

2 Resumes

HANNAH AKER

1104 4th Street Apt. A • Rapid City, SD 57701
(605)-786-7639 • hannah.aker@mines.sdsmt.edu

INDUSTRY EXPERIENCE

AFMC-OCALC, 76th SMXG, 555th MXDED

Summer 2014, Summer 2015

SMART Intern

Oklahoma City, OK

- Designed and implemented software tool to view and edit aircraft engine data files for use in developing and testing CETADS (Comprehensive Engine Trending and Diagnostics System), using C#, Windows Forms, WPF, XAML, and MVVM architecture.
- Summer 2014: created proof of concept program with complete functionality in Windows Forms, and created test cases for CETADS by hand using a hex editor.
- Summer 2015: improved original program using WPF, XAML, and MVVM structure, then recreated the program for a different engine.
- Supervisor: Francesco Whittenberger, francesco.whittenberger@us.af.mil

TECHNICAL SKILLS

Programming Languages

C, C++, C#, Java, PHP, SQL

Operating Systems

Windows 7, Linux

EDUCATION

South Dakota School of Mines and Technology

August 2012 - Present

Bachelor of Science in Computer Science

Minor in Mathematics

GPA: 3.571

Academic Projects

- Mobile Computing - Teamwork in Agile Scrum to create Android application to facilitate communication between students for academic purposes, using Java for Android and MVC structure. Project work at github.com/SDSMT-CSC476/SP15-Team1-AndroidApp
- Digital Image Processing - Teamwork to implement Hausdorff face detection, where user provides template and image and the program will identify matches to the template in the image, using C++ and Qt. Project work at github.com/hannahaker/dip_project

Awards

- SMART Scholarship for Service, awarded July 2013 The Science, Mathematics And Research for Transformation (SMART) Program scholarship for service program is a national full scholarship leading to employment upon degree completion; sponsored by the Department of Defense(DoD). More information at smart.asee.org

Campus Involvement

- Symphonic Band (1st chair Bassoon)
- Lions Club, an international community service organization
- Student Aide (Graduate Education Office), Teachers Assistant (College Algebra Lab)

OTHER EXPERIENCE

SDSM&T Math and Computer Science Department

Teachers Assistant

August 2015 - Present

Rapid City, SD

- Lead college algebra lab, assist students with lab work, evaluate student lab work
- Supervisor: Dr. Donna Kliche, donna.kliche@sdsmt.edu

SDSM&T Graduate Education Office

Student Aide

May 2013 - Present

Rapid City, SD

- Process new applications, answer emails, manage applications spreadsheet in Microsoft Excel, file applications, and process incoming mail.
- Supervisor: Rachel Howard, rachel.howard@sdsmt.edu, (605) 355-3468

SDSM&T Math and Computer Science Department

Student Aide

September 2013 - February 2014

Rapid City, SD

- Run trials of provided MATLAB program, created Microsoft Excel spreadsheet of results
- Supervisor: Dr. Karen Braman, karen.braman@sdsmt.edu

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