Project Plan Document

for

Chemistry Equilibrium Visualization

Version 1.1 approved

Prepared by Corey Staier

De’Toine Jones

Daniel Schaub

18 February 2019

1. Introduction

1.1 Purpose

This document details the design, structure, and client requirements for Chemistry Equilibrium Visualization as requested by Dr. Ray Scott. Dr. Scott is the primary audience of this document, with secondary audiences including the implementation and testing teams that will later take over this project.

1.2 Scope

The client, Ray Scott wants a visual aid to assist his students in the understanding of equilibrium. The students are the main users of the system. The software helps these students by providing a hands-on, visual representation of equilibrium.

1.3 References

Khan Academy (https://www.khanacademy.org/science/chemistry/chemical-equilibrium) serves as a reference to clarify principles of elementary chemical equilibrium and use of the k-constant as it relates to chemical systems. Information is provided about factors that influence chemical equilibrium outside of k-constant, though reaction quotients and the like lie outside the scope of this project as it is currently established.

1.4 Overview of the remainder of the document

The rest of this document gives an overview of the project and its purpose with details of its intended users, basic requirements and project descriptions. User stories, non-requirements and diagrams will also be included near the end of the document to further explain the software's ability.

2. Project Description

2.1 System overview

Chemistry Equilibrium Visualization allows students to view models of chemical equilibrium as represented by the seesaw metaphor and to learn how their changes to aspects of the system affect the balance as a whole. To accomplish this, students are provided with a simple visual representation of chemicals on a seesaw, a field to change the equilibrium constant, and a field to change the percentages of chemicals present. Students may either change the equilibrium constant k (noting change in the fulcrum of the seesaw and chemicals present), the chemical percentages (noting change in k and in the fulcrum and sizes of seesaw loads), or the fulcrum itself (noting change in k and chemical percentages).

2.2 Client characteristics

Dr. Ray Scott is a Chemistry professor at the University of Mary Washington. In his years of teaching, he has found that many of his students tend to find the topic of equilibrium a bit difficult to understand. He desires to have software that introduces the topic in a manner that is interactive and easy to understand.

2.3 User characteristics

Dr. Scott and his students are intended to utilize the software with Dr. Scott having the ability to demo the software in front of his students in class on a projector screen and his students having personal access to the software to use for themselves.

2.4 Functional requirements

The product will open to a start screen where the user has two options

- Manual Button

If selected, user is able to manipulate an aspect of the program. User must then configure other aspects to the new values of the manipulated aspect.

- Automatic Button

If selected, user is able to manipulate an aspect of the program. System will calculate new values of the other aspects and configure accordingly, user can watch.

3. Project Schedule

3.1 Approach

The program is a three part creation: the first part being the math involved necessary to compute equilibrium; the second part being the graphical interface interacted with and representing changes in values in the math through resizing shapes; and the third part is hosting the program through use of the web. If those three core parts can be completed, we may continue work on further sections like automatic mode, manual mode, and another labelled ‘Competition’ in which scores will be awarded for guessing correctly the values to complete the equation.

3.2 Milestones and Deliverables

Milestone A:

- A functional GUI/user interface of any sort.

Milestone B:

- The shapes representing chemical amounts will resize in proportion to the equation.

Milestone C:

- An interactable program with some capabilities hosted on web and accessible through browser.

Milestone D:

- A working functional algorithm that provides the correct answer to an equilibrium problem, implemented inside web-hosted graphic system.

Milestone E:

- A working program through web, that has a basic scoring system in place.

Deliverable A:

- A demonstrable GUI/user interface with a not necessarily interactive element that has arrows, shapes, and a slider.

Deliverable B:

- A demonstrable correct equation solving using input from boxes/sliders on the GUI/user interface. Not necessary for shapes to be active, nor anything to scale as long as it shows compatibility between algorithm and interface, and the algorithm is correct

Deliverable C:

- A web-hosted program with working graphics and equation and interactive elements.

Deliverable D:

- A web-hosted program with both automatic and manual functionalities. All graphical elements in place and correctly working. An essentially complete equilibrium program without scoreboard functionality.

Deliverable E:

- A scoreboard website. Not required to be fully functional/integrated with program

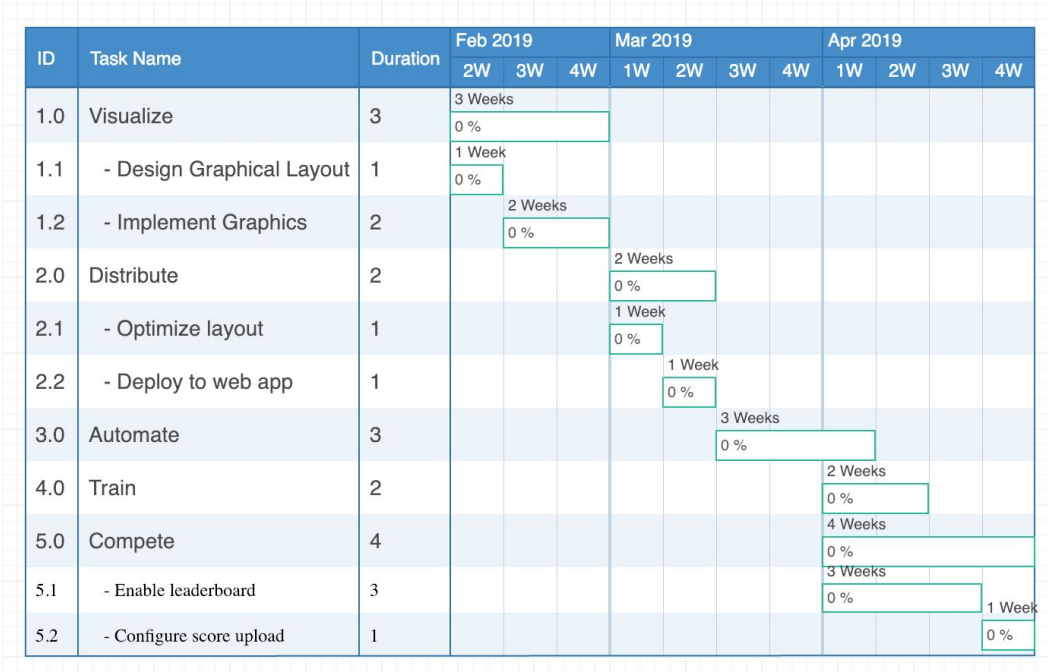
3.3 Work Breakdown Structure

1.0 Equilibrium Program

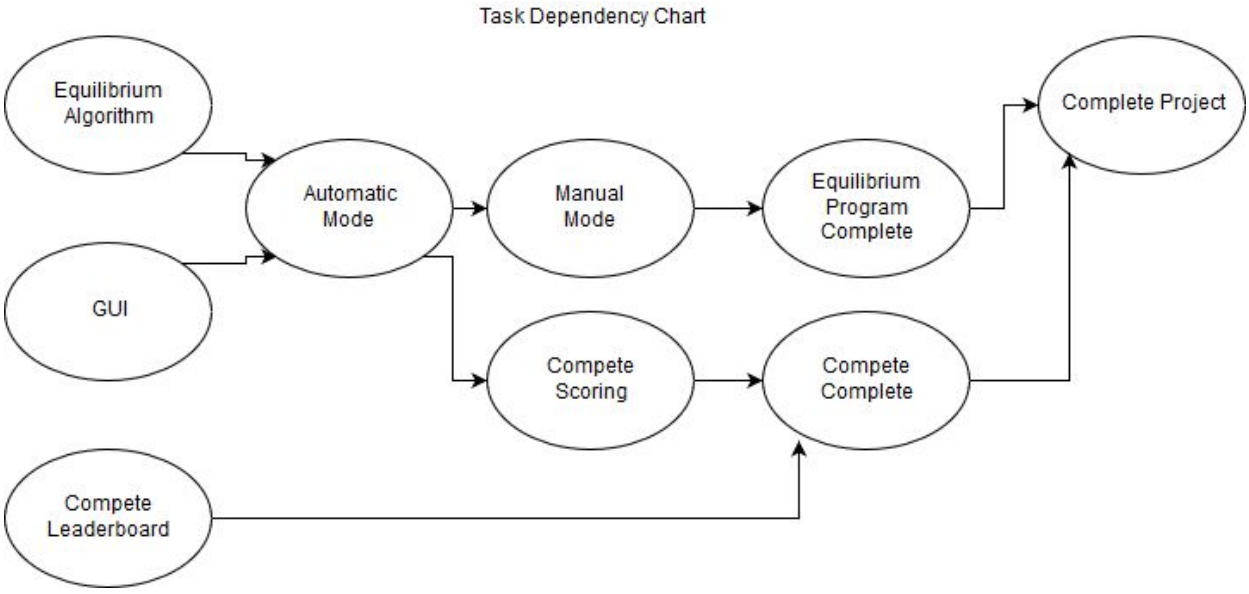
- 1.1 **Milestone A** - Graphical Interface, 3 week
  - 1.1.1 - **Deliverable A** - Design, 1 weeks
    - Working closely with client. Will likely vary in end result to present
  - 1.1.2 - Implement, 2 week
    - Implementing a graphical interface usually is a burdensome process and errors take a while to fix.
  - 1.1.3 - **Milestone B** - Resize Capabilities
- 1.3 **Milestone C** - Web Hosting, 2 week
  - 1.3.1 - Optimize Layout for transition to web, 1 week
  - 1.3.2 - Deployment on web, 1 week
- 1.4 **Milestone D -** Automatic Mode (Automate), 3 weeks
  - 1.4.1 - **Deliverable B** - Working Equilibrium Algorithm
  - 1.4.2 - Connectivity with graphics
  - 1.4.3 - **Deliverable C** - Workable Automate button
  - 1.4.4 - Extensive Testing
- 1.5 **Deliverable D** - Manual Mode (Train), 2 weeks
  - Uses existing algorithm from Automatic Mode. Main bulk of time will likely be testing and resolving problems.
- 1.6 **Milestone E** - Compete, 4 weeks
  - 1.6.1 Enable Leaderboard, 3 weeks
    - 1.6.1.1 - Scoring Functionality
    - 1.6.1.2 - Scoreboard Creation
    - 1.6.1.3 - **Deliverable E** - Scoreboard Web Hosting
    - 1.6.1.4 - Scoreboard Maintenance Tools
  - 1.6.2 Configure Score Upload, 1 week

3.4 Gannt chart

The Gannt chart, shown below, visually breaks down each major section of the design process. Major sections (Visualization, Distribution, Automation, Training, and Competition) are listed in order with their respective subtasks further dividing the allotted time. Overlap between automation and training is included as training only depends on work in the first section of automation and as competition and training are outlined and developed together.



3.5 Task Dependency Diagram



The Automatic Mode is the point of merging the working algorithm with the graphics part of the program, and that naturally feeds into Manual Mode. Those all complete are the bulk of the equilibrium program.

The Compete Leaderboard is a standalone web page that is destined to gain input from the equilibrium program once it’s mostly together. Compete Leaderboard when combined with a working Scoring system is then considered complete.

4. Appendix

4.1 Glossary of terms related to your project

Equilibrium: when the concentrations of reactants and products are constant and their ratio does not vary.
Fulcrum: the support about which a lever turns. In the system the fulcrum is what the seesaw rests upon.
Reactant: a substance or substances that are changed into other substances.
Product: a substance that is formed as the result of a chemical reaction.
Equilibrium Constant (k): a number that expresses the relationship between the amounts of products and reactants present at equilibrium in a reversible chemical reaction at a given temperature.

4.2 Author information

Corey Staier
Introduction, Project Description, Non-Requirements, Assumptions, Glossary, Gannt

De'Toine Jones
Introduction, Project Description, Requirements, Assumptions, Glossary

Daniel Schaub
Template, Project Schedule, Milestones and Deliverables, Work Breakdown Structure, Task Dependency Chart

4.3 Additional documents

- Start up page when user opens software.

- Example of blank template of what the user sees when running the program.