Senior Design
Final Fall Design Report

CSPrep: A Tool for Computer Science Education

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Loc Tran

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1. Project Description

CSPrep: A Tool for Computer Science Education

Background

Computer Science (CS) is one of the fastest growing fields in the United States. It can be applied to almost every field of study and is a desired compliment to several degrees. While it may be an easy choice for postsecondary education, learning the foundational concepts is not as easy.

Problem Statement

CS can be daunting to the novice. Learning complex processes and abstract thinking is a step that all must take when tackling this subject. This is usually learned through pseudocode and application while sometimes the student may be able to apply, but not necessarily understand what is happening behind the scenes and why it is important.

Team Members

Zach Carey - careyzr@mail.uc.edu

Loc Tran - tran2l@mail.uc.edu

Faculty Advisor

Dr. Kenneth Berman

Goal

Develop an iOS application that describes introductory to intermediate algorithmic processes and data structures simply and intuitively to the user.

Helpful Skills

- Swift 3+
- Xcode 8+
- Interactive Javascript

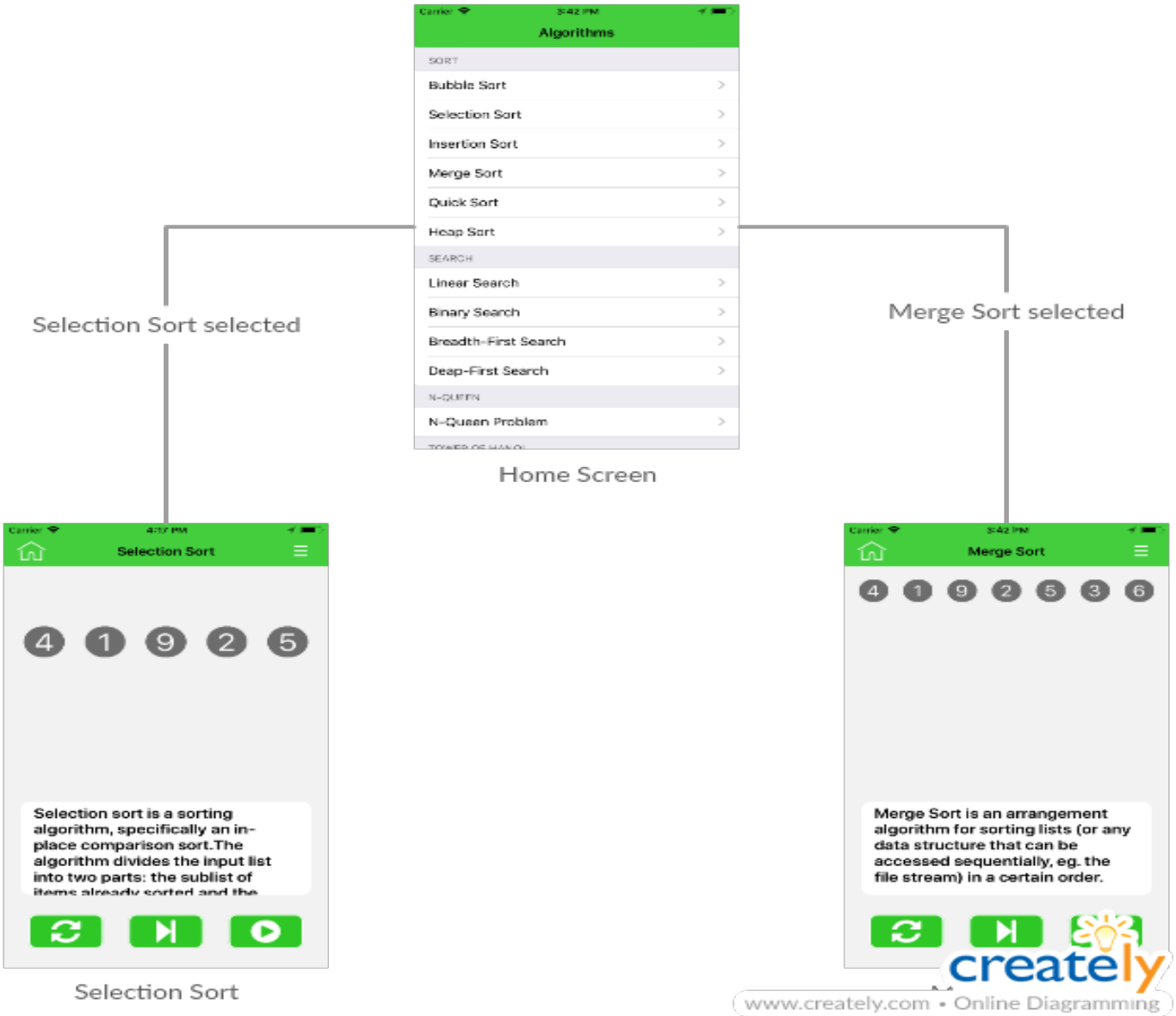
2. User Stories and Design Diagrams

User Stories

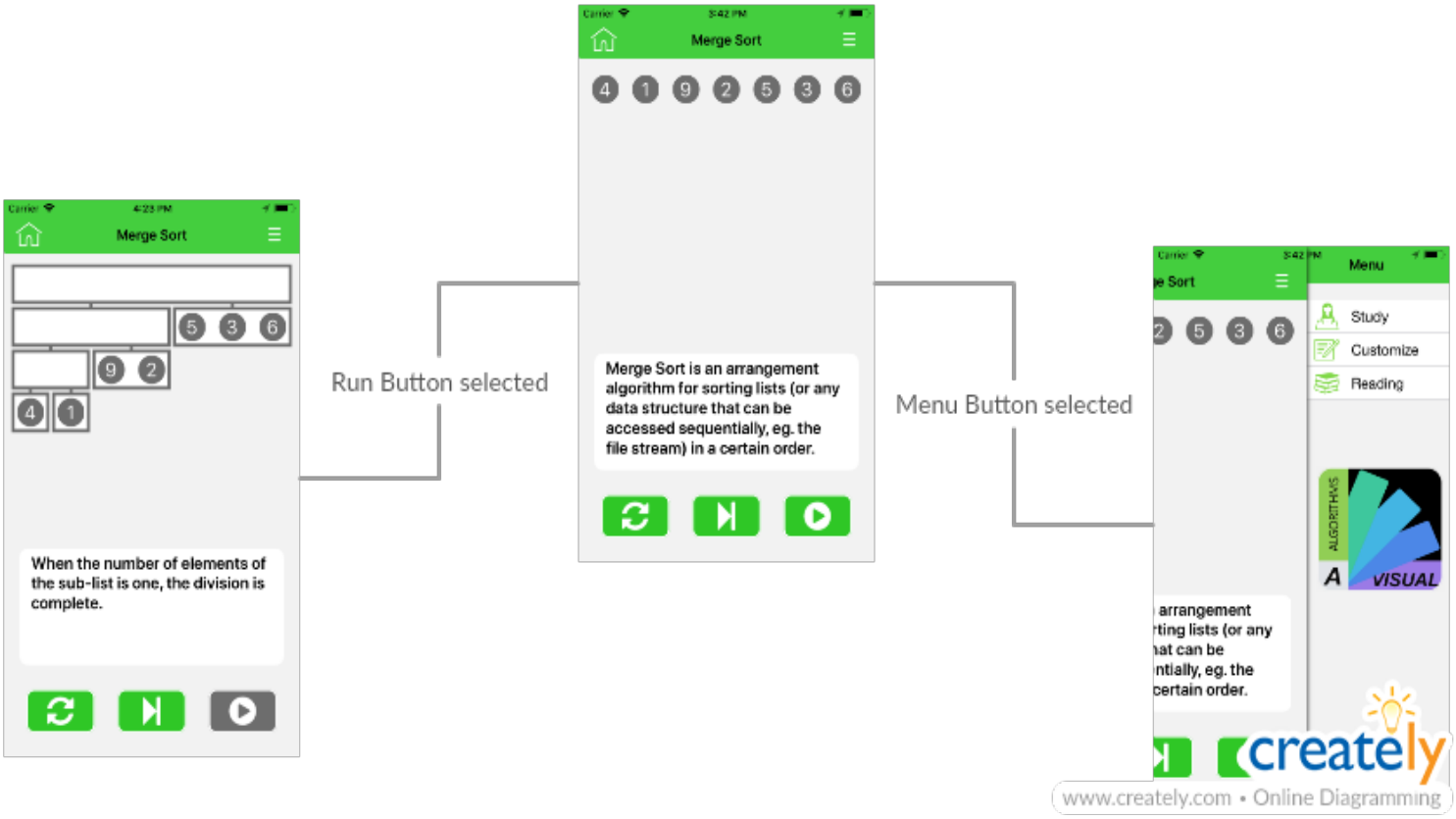
As a student using this app, I want to visualize algorithms so I can understand computer science concepts better.

As a teacher using this app, I wish to display how alogrithms perform so that my pupils can become better problem solvers.

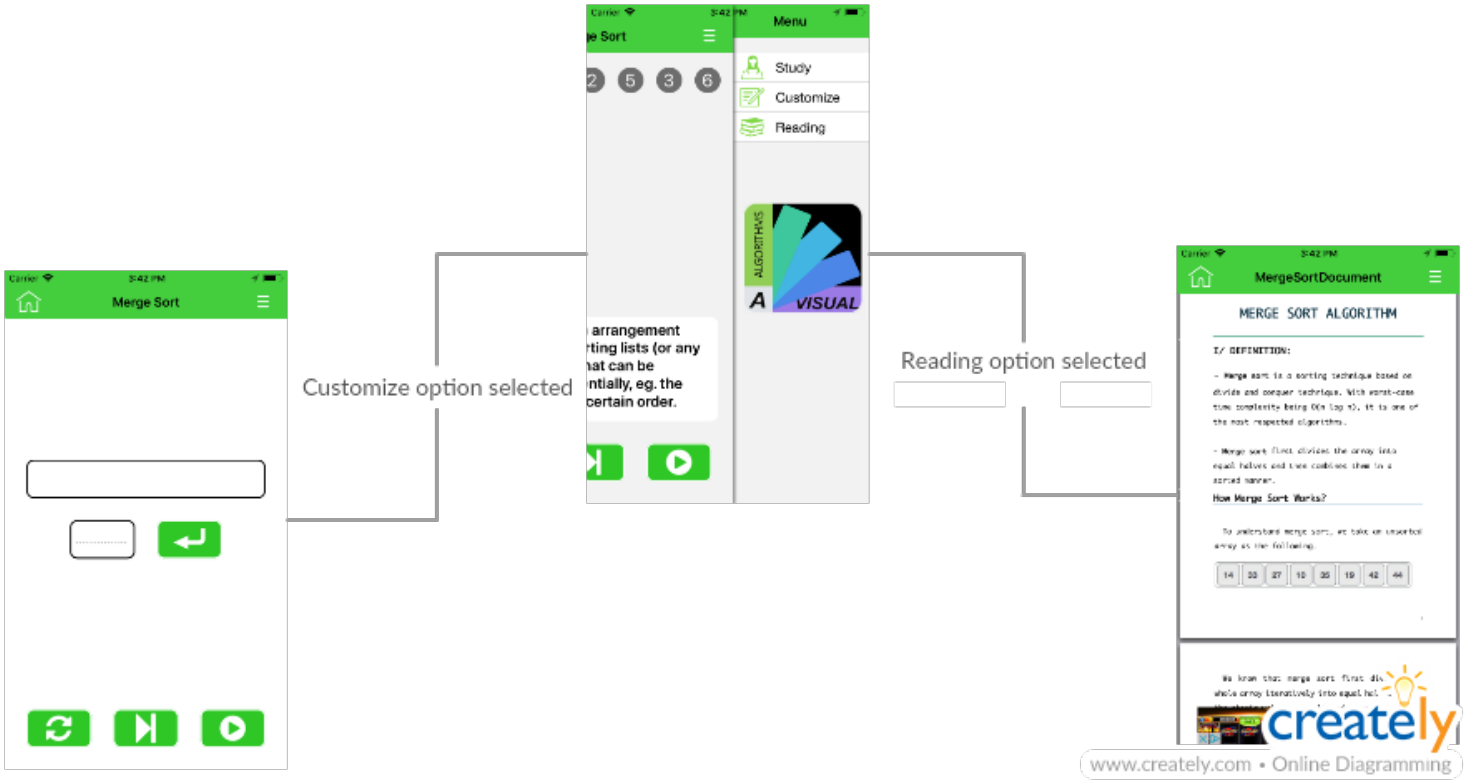
Design Diagram I



Design Diagram II



Design Diagram III



Design Descriptions

Design Module I: Upon opening the app, the user will be at the Home screen. Here the user will be able to choose which algorithms or concepts they want to view.

Goal I: Display list of algorithms and CS Concepts on the Home Screen.

Design Module II: Once selected, the content display is dependent on the chosen concept. Here in the concept module screen, the user can click ‘play’ which will step through the process or step through it manually by clicking the ‘next’ icon.

Goal II: Display animations that can be stepped through manually or automatically.

Design Module III: In a concept module screen, the user can select the settings option in the top right corner. Here the user can edit the dataset as well as read a description and pseudocode for the selected concept.

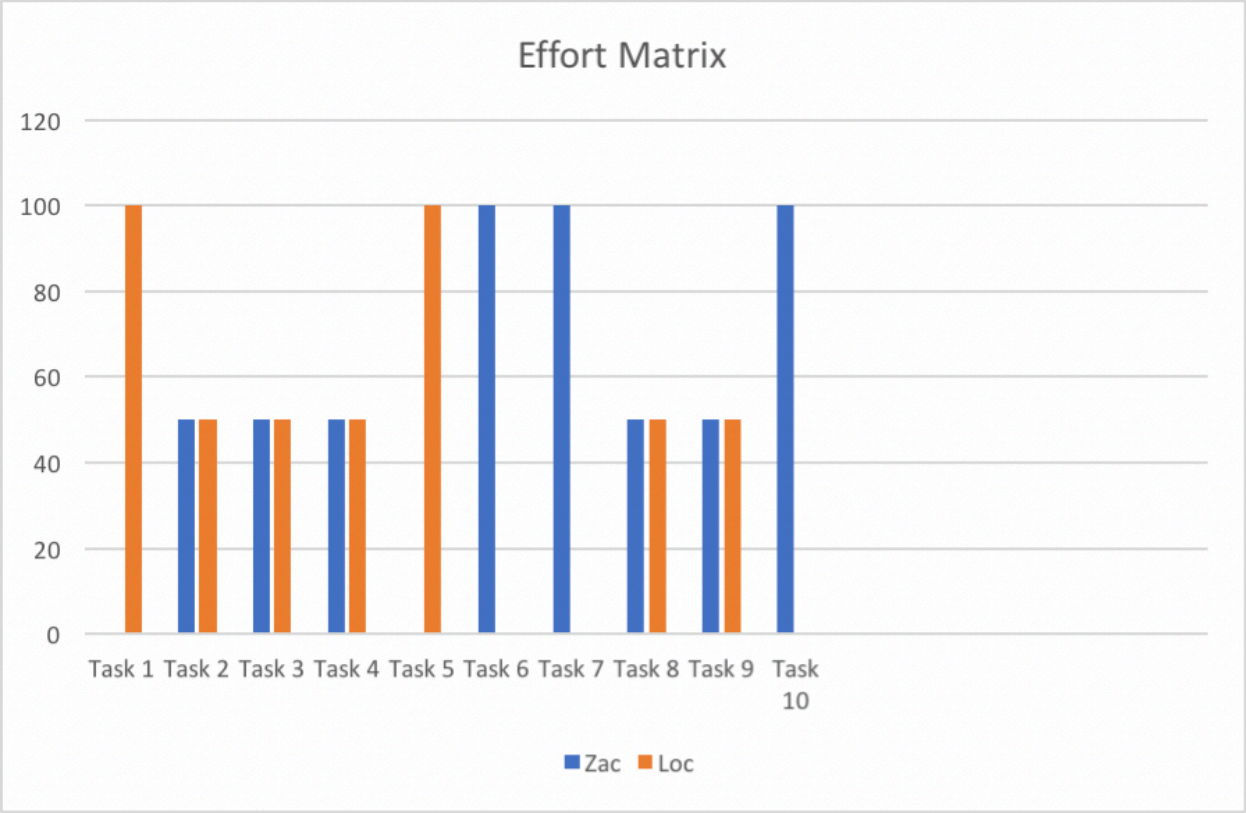
Goal III: Allow users to choose a dataset and read the description of the selected concept.

3. Project Tasks and Timeline

Tasks & Timeline

Task #	Statement	Member	Days	Tentative Start	Finished
1	Update Project to Xcode 9	Loc	1	1/7	
2	Refactor design themes	Zach & Loc	1	1/8	
3	Implement Data Structures	Zach & Loc	6	1/9	
4	Obtain Gifs of Algorithms	Zach & Loc	2	1/13	
5	Implement Sort Algorithms	Loc	30	1/15	
6	Implement Search Algorithms	Zach	30	1/15	
7	Test on a real device (iPad & iPhone)	Zach	5	2/15	
8	Meet with Advisor Dr. Berman for advice and revisions	Zach & Loc	1	2/20	
9	Complete revisions and any edits	Zach & Loc	10	2/20	
10	Set up website	Zach	3	3/1	

Effort Matrix



ABET Constraints

Economic

Our project is to create an iOS application that can run on iOS 8.0 and above devices. Therefore, it is important to have an up-to-date iOS device to test the application. One team member, Zachary Carey, has an iPhone 5S that we can test the application on. However, iPhone 5S can only work best with iOS 8 and iOS 9, so a team member, Loc Tran, will purchase an iPhone X which costs about one thousand dollars. The fund will be supplied personally by Loc Tran. Another expense that our team will need to purchase is the fee to register Apple developer accounts, which is one hundred dollars per account per year. Each of team members need to cover this expense by themselves. At the end of Spring semester, we will publish this application on AppStore and it will be free to download. This application will contain advertisement from AdMob by Google.

Professional

This senior design project has a direct impact on professional development of both team members, Zachary Carey and Loc Tran. Each team member has been working as iOS developers, and this project will stand out as one of the first achievement for future career of each team member. This project can also be deployed into academic environment to help computer-science freshmen student having a better and easier understanding of basic algorithms and data structure, which are the critical keys in CS major. If this project has successfully been accomplished and accepted by the council of professors at UC, it will be used as an appendix in delivering key concepts in the two courses such as Computer Science I & II and Data Structure.

Ethical

Since the goal of this app is to teach students Computer Science concepts it is imperative that the information communicated from the app to the user is accurate. Anything less than accurate would undermine the whole point of creating the

application. In order to ensure the app's legitimacy Loc and Zach must both test it and get capable eyes to review the app as well (Peer Review).

Social

Our app is meant as a tool for public service to teach and learn Computer Science. While we plan to monetize through ads and an ad-free paid version, there will not be any content behind a paywall. All content can be reached through either version. We hope to make CS students' lives easier by providing a tool which can help them learn foundational to advanced CS concepts.

Slideshow

Slideshow can be found here: https://github.com/zacarey/CS5001/tree/master/Capstone/Slideshow

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Self-Assessment Essays

Zach Carey

Introduction

Our project is an iOS application that teaches Computer Science concepts with a focus on data structures and algorithmic processes. We wish to communicate basic to complex processes through the use of graphics, animations, text, and user input. The goal is to increase the student's comprehenison and ability in the domain of Computer Science, specifically with algorithms.

Past Experience

As a senior in CS we have the necessary knowledge of foundational algorithms and beyond. Classes like Data Structures and Design & Analysis of Algorithms will be

excellent references in our project. In our current trajectory, we will implement algorithms for search and graphs. Algorithms such as bubble sort to more complex processes like merge sort have repeatedly shown up in course work. That is why we hope to convey them easily and accurately for an in depth learning environment and future referencing.

My co-op experience isn't strictly related to this project. I do .NET developing at my current co-op for large scale web applications. This project will be strictly swift with some javascript peppered in. I have minimal swift experience, but I am excited to learn more about iOS development.

Motivation and Project Approach

What excites me most about this project is that this could really help some people understand the complex concepts of Computer Science. I'm hoping that we can tackle these topics in such a way that students can learn a topic visually, textually, and/or by application.

Currently we're appraching this project topically. Loc will be handling sorting algorithms while I do searching. We plan on diving into graphs as well once we're stable with the basics. Hopefully, this can be used as a teaching tool for Computer Science professors.

Loc Tran

Introduction

The name of the project is Learning Data Structures and Algorithms. The main objective of this project is to create an iOS application that helps Computer Science students to learn data structures and algorithms. This application will demonstrate step-by-step the explanation and animation of some basic CS data structures and algorithms. Data structure, that might be included, are Linked-List, Stacks and Queues. Algorithms, that will be demonstrated, are Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Linear Search, Binary Search, Breadth-First Search and Depth-First Search. This application will have two options for users. First option is Study. When users select this option, the application will provide a set of fixed data. In this mode, the application will provide a short explanation in text belong to the animation. The second

option is Customize. In this mode, users can enter their set of data. This application also provides PDF documents that briefly describe the algorithms and data structure as well as their pseudo code.

Motivation

I choose this project because I think this application will be helpful for Computer Science major students. I found that it was very important to understand data structure and algorithms to be a good developer. I have had Data Structures course and Design & Analysis of Algorithms course. These two courses were very helpful for me. However, I also found that it was difficult to deeply understand the contents of these two courses just by reading the texts. I always needed my professors to demonstrate some examples by hand so that we can understand better. I think it is a very good idea to have an application that students can quickly access and see the animation of these data structures and algorithms.

Past Experience

The last two co-op positions that I had were iOS application developer at Techmaster Vietnam. I have learned many valuable knowledges during these two co-op semesters. I had a chance to learn a new programming language, which is Swift. I had built some small iOS applications by myself and with the team. I have learned how to build an iOS application from the scratch, how to work with the team, and how to present our application to the CEO as well as customers. These two co-op semesters help me to decide my career path. I am very interested in being an iOS developer. During these co-ops, the most useful knowledges and skills that I have used the most were studied from Data Structures and Design & Analysis of Algorithms courses.

After my last two co-op semesters, I decided to build an iOS application for my senior design project. As stated above, I have had some difficulties of understanding data structures and algorithms and I found that it was very important to understand these contents to do a good job in real life work. Therefore, I decided that my application will be about learning Data Structure and Algorithms. I have discussed with my partner –

Zach Carey, I decided that this application will be a native app. This project should a straight forward project. I will be in charge of implementation of Sorting Algorithms. And Zach will implement Searching Algorithms and other Data Structures. We will collect the documentation from previous courses and from our faculty advisor.

The expectation of this project is a working application that can run smoothly on any iOS devices. I expect to publish this application on AppStore before March. The biggest accomplishment that I want to achieve is the professors who will teach Data Structures and Design & Analysis of Algorithms course would use my application for their teaching.

Professional Biographies

Loc Tran

iOS Swift developer - Techmaster Vietnam

- January, 2017 - August, 2017
- Created and developed iOS applications using Swift
- Design iOS application layout using SketchApp

Web developer - RosyGrass Netherland

- May, 2016 - August, 2016
- Created, developed and designed websites using CSS and HTML
- Maintained websites

Digital Content Operation Assistant - Cengage Learning Mason

- January, 2015 - August, 2015
- Managed and maintained the companion site
- Generated eBook vocabularies, flashcards and game from Excel sheet using Python
- Customer support

HPLC Laboratory Assistant - Vietnam Institute of Dietary Supplements

- May, 2013 - August, 2013
- Operated lab computers and HPLC machines
- Analyzed data using MySQL and Excel

Zach Carey

Gardner Business Media, Inc

- January, 2017 - Present
- .NET Full Stack Developer
- SQL Server Developer

Fascor, Inc

- January, 2016 - May, 2016
- .NET Backend Developer
- SQL Server Developer

Intelligrated, Inc

- January, 2015 - December, 2015
- Oracle IT Co-op

Skills

- Proficient in C#, SQL (SQL Server and MYSQL), Swift, PHP
- Mobile Development (Native Android and iOS)
- Web Development (.NET, Laravel)

Personal Projects

- Created QuestX: an iOS application that communicates with a Laravel web application as the API and contains the Quest Management Portal.

Budget

The current budget for this project is $0.

Appendix

Repository can be found here:

https://github.com/zacarey/CS5001