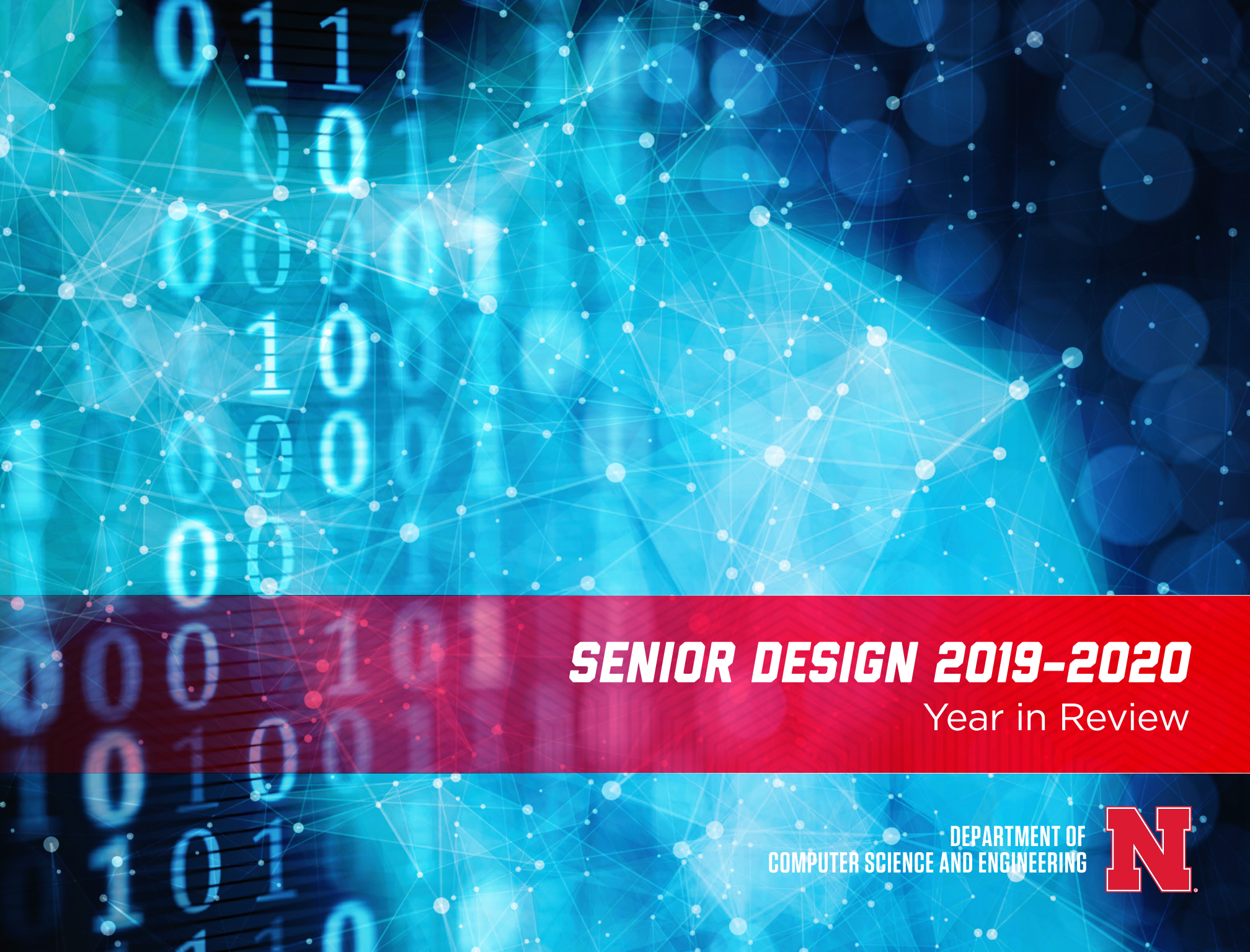


# SENIOR DESIGN 2019-2020

## Year in Review

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

## SENIOR DESIGN MISSION

Senior Design provides a project-based capstone course that gives students a design-centered educational experience. Our students focus on the applications of software and systems engineering principles to solve complex problems through the design, development, and implementation of innovative computing systems.

## SENIOR DESIGN CORE VALUES

Our core values reflect the Department of Computer Science and Engineering's 50-year history, mission, and beliefs:

By teaching essential skills and providing globally recognized research and training opportunities, we prepare students for the most challenging, innovative, and fastest-growing careers of the 21st Century. Featuring world-class facilities, a groundbreaking curriculum, the University of Nebraska–Lincoln's Department of Computer Science and Engineering is one of the country's top computer science and engineering programs—including one of the top five in software engineering.

## MESSAGE FROM THE DIRECTOR

Dear friends,

Welcome to the Department of Computer Science and Engineering's Senior Design Year in Review Report for the 2019-2020 academic year.

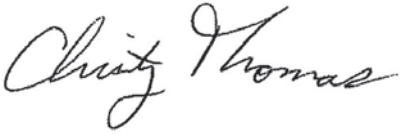
Thank you for taking a few minutes to read about the projects from this year's portfolio. The following pages highlight the final outcome of the collective efforts to meet the project-based course requirements that prepare our next generation of talented computer scientists, computer engineers, and software engineers.

You cannot talk about Senior Design students and their project sponsors without giving credit to their resilience. They have collaborated through the entire development lifecycle while addressing challenges and celebrating victories. We appreciate their hard work and dedication. We are proud of their accomplishments and feel honored to have worked alongside them this past academic year.

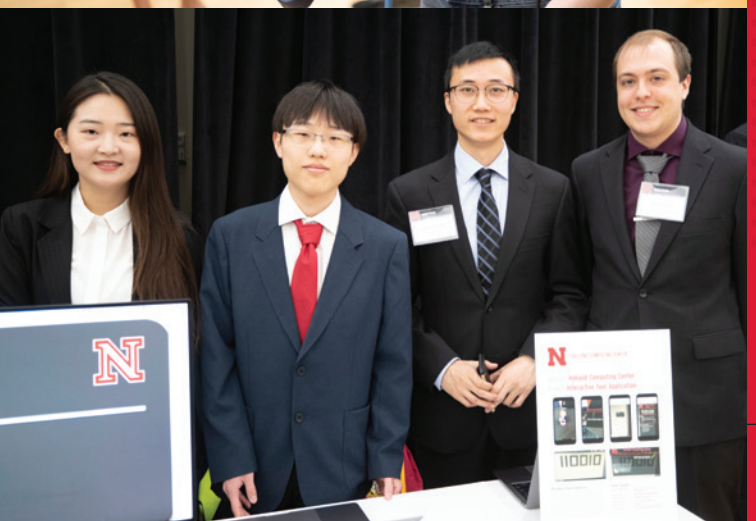
I would like to express my sincere appreciation to the Senior Design staff and faculty for their support of the capstone program. Our collective strength is in their unrelenting commitment to student success. I want to give a big 'Thank You' to those that generously provided our students with space at the Johnny Carson Center for Emerging Media Arts, Nebraska Union, Jackie Gaughan Multicultural Center, Louise Pound Hall and Brace Labs.

As I reflect back to 2019-20, I recognize the value of our community with our system-wide partners across the University of Nebraska, our industry sponsors, and those listed in the *Special Thanks* section at the end of this report.

With Gratitude,



Christy Thomas
Director of Senior Design



## SENIOR DESIGN OVERVIEW

We are the Department of Computer Science and Engineering Capstone program. Our students have experience in multiple programming languages and development platforms and can offer you a wide variety of project types.

- Web Development
- Mobile Apps
- Data Analytics
- Internet of Things
- VR / AR
- Machine Learning
- Gaming
- Geographic Info Systems

We work with industry and academic partners to create great software, hardware, and/or IoT applications.

## INTERESTED IN SPONSORING A PROJECT?

Please fill out the project proposal form:
**go.unl.edu/senior_design_project_proposal**

## CONTACT SENIOR DESIGN ABOUT YOUR NEXT PROJECT VIA EMAIL AT:

**cse-seniordesign@unl.edu**

## VISIT OUR WEBSITE FOR MORE INFORMATION:

**cse.unl.edu/senior-design**

## MARILYN C. WOLF

Koch Professor of Engineering and Chair

Department of Computer Science
and Engineering

Senior Design is one of the most important components of our educational mission. This year-long project allows students to synthesize what they have learned throughout their UNL experience. Putting together the pieces gives students a deeper understanding of why we have put them through their paces in so many diverse courses. Senior Design also teaches them important skills in project management that will hold them in good stead no matter what career they may pursue. Students work on projects together with students who encompass a range of backgrounds, skills, and experience. I had the pleasure of working with my own team this year; I hope that the students enjoyed the experience as much as I did. That is due in large part to the efforts of our Senior Design staff and faculty who guide students through challenges both big and small to arrive at a successful conclusion.


## SENIOR DESIGN STATISTICS

| | |
|---|---|
| 167 # OF STUDENTS | 28 # OF TEAMS |
| 45,090 HOURS OF STUDENT DEVELOPMENT | 780 HOURS OF SPONSOR MEETINGS |
| 23 # OF STUDENT AWS USERS | 26 # OF SPONSORS |
| 12 # OF TEAMS USING AWS | 172 # OF CANVAS USERS |
| 5 # OF IOS MOBILE TEAMS | 4 # OF ANDROID MOBILE TEAMS |

## TECHNOLOGIES USED

| | | | | | |
|---|---|---|---|---|---|
| 17 | JS | 2 | SQL Server | 1 | Java |
| 8 | .NET | 2 | unity | 1 | [ObjC] |
| 5 | MySQL | 2 | V | 1 | php |
| 5 | python | 1 | Dart | 1 | Swift |
| 3 | PostgreSQL | | | | |

## PROJECT DOMAINS

| | | | |
|---|---|---|---|
| 7 | MOBILE DEVELOPMENT | 3 | VIRTUAL REALITY |
| 6 | ALGORITHM DEVELOPMENT | 2 | PRODUCT DEVELOPMENT |
| 4 | DATA SCIENCE | 2 | RESEARCH & DEVELOPMENT |
| 4 | WEB DEVELOPMENT | 1 | BUSINESS DEVELOPMENT |
| 3 | INTERNET OF THINGS | 1 | GEOGRAPHIC INFORMATION SYSTEMS |

Buckle

Sponsor: **Buckle**

Project: **Social Media Marketing**

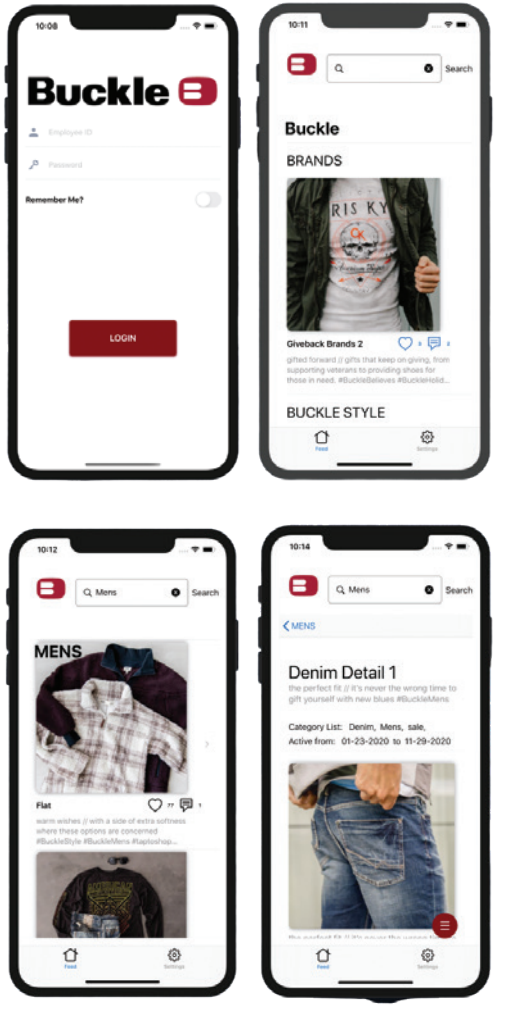
The greatest shortcomings of the current solution is that the development toolset chosen for the project was a bit ahead of its time. With SwiftUI (a brand new tool by Apple to create user interfaces with fewer lines of code) at the forefront of technologies utilized in developing the social media marketing application, it proved difficult at times to properly integrate with existing codebases. A prime example of these problems arose when it became time to attempt to integrate with major social media platforms such as Facebook and Instagram—platforms that had yet to allocate time into writing documentation to interface with SwiftUI applications. SwiftUI is, without a doubt, a power tool that requires time to mature before being put to use as an industry standard.

The Buckle's senior design team developed an application that allows registered Buckle employees to login and view a feed of categorized marketing posts to be interacted with individually. A user has the option to view approved posts, share them to their social media channels, comment on these posts, and search the feed by category to filter their results. The application can be deployed to any iOS application and allows a marketing employee to share preapproved images with preset captions to their personal accounts. However, it does not lock down these fields to their presets, as users are still able to modify content prior to sharing.

The application features a Drupal backend that is not meant to be interacted with by a regular user. In the current state of the application, it is impossible to write marketing content to the backend aside from liking and commenting on individual posts. Using a standard REST API in order to make requests to and from Drupal, the application aggregates content into a cleaner, more marketing-oriented user interface to make the lives of countless marketing employees at the Buckle easier.

## THE TEAM

| | |
|---|---|
| Ryan Le | Squad Lead and Product Manager |
| Kailei Mao | Development Manager |
| Arreya Ahrom | Developer |
| Jake Ediger | Developer |
| Dennis Qi | Developer |
| Olivia Rine | Developer |



DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Chris Bourke, Libby Jones, Joshua Steelman**

Project: **VR for Structures & VR for Playing in Traffic**

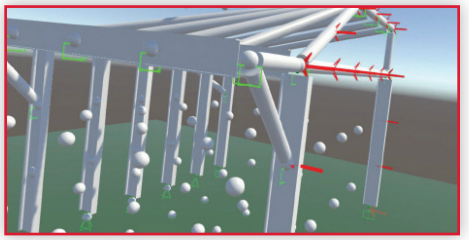
For VR for Structures, the intention was to create an application to build, analyze, and view structures in a virtual space, letting users see their structure with a greater sense of scale. This project was started last year by another team, who built the project in Unity, communicating to the construction application SAP 2000 for analysis.

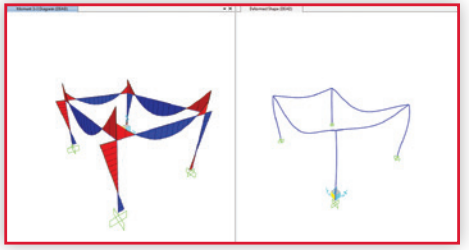
We were tasked with extending the previous design, and have made significant improvements. Some examples include: redesigned menus, better performance and reliability, more information for the user, and greatly extended functionality. It offers many of the features of SAP 2000 in an accessible VR interface.

Playing In Traffic was to create a virtual reality viewing space in which 360° videos could be uploaded and used to view the traffic activities. Through this VR solution there is an instructor mode and student mode. Both modes have different purposes, but this is so that the students will have a more “real-time” experience while completing the activity while the instructor is able to supervise.

## THE TEAM

| | |
|---|---|
| **Camryn Moy** | **Squad Lead and Product Manager** |
| **Devin Hastings** | **Development Manager** |
| **Neil Chen** | **Developer** |
| **Zihan Kou** | **Developer** |
| **Joyal Li** | **Developer** |






DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Massimiliano Pierobon**

Project: **Paredox**

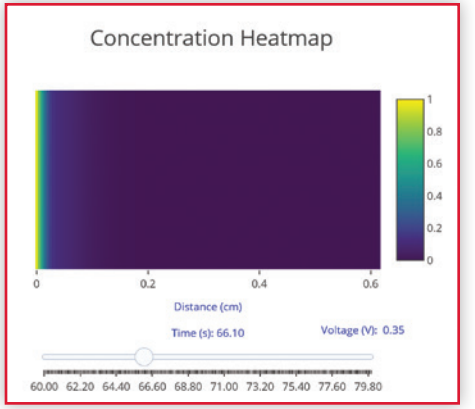
Paredox is a tool designed for researchers and engineers to expedite the process used to obtain the behavior of bioelectronic systems. It was envisioned to give its users the tools to design systems that use biological interfacing in this brand-new field of research and design. Paredox itself enables this by providing an easy to access website that runs the simulations; given input data.

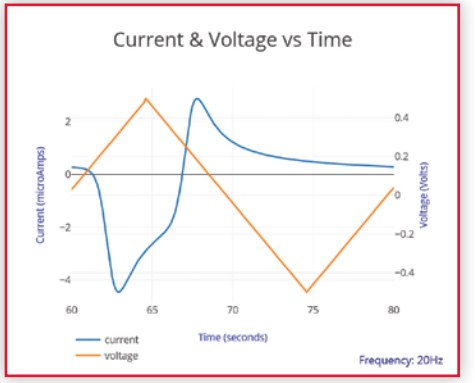
This project works by connecting underlying simulation code that is embedded deep in the system with users over the internet. It allows them to run simulations on this code and export it onto their own systems for later use and analysis. Administrators can also create advanced species which are integral to the simulation but once discovered, don't need to be rewritten like simulation settings do.

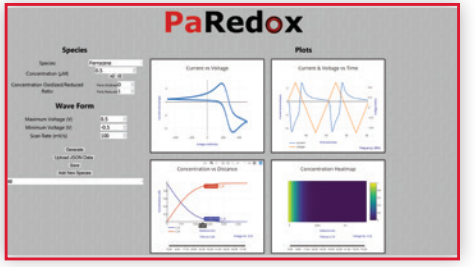
This project was developed in tandem with the simulations provided by the research associates. It began by exploring the best options to show these simulations; investigating local applications vs server applications. Server applications won after a few demos and this turned them into local host projects; to be deployed later. After several iterations in the local host, it was finally deployed to a server and easily accessible thereon. The simulation during this next period of time was updated and allowed for new functionality to be shown in Paredox, including things like Heatmaps and adding species. The framework was adapted to the new simulation and input testing was added at this point too. The development for Paredox went smoothly after the server was implemented and Paredox has turned into a stable platform, limited only by what the user can use the data for.

## THE TEAM

| | |
|---|---|
| Jacob Orellana | Squad Lead and Development Manager |
| Rustin Haase | Product Manager |
| Robin Bouma | Developer |
| Nathan Doher | Developer |
| Beau Hottovy | Developer |
| Tyler Zinsmaster | Developer |



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Francisco Munoz-Arriola, Byrav Ramamurthy**

Project: **Genetics by Environment: A Phenotype Predictive System (GeEn).**

The team was tasked with combining two pre-existing software into a website that is easily accessible by researchers. One software is a statistical model that makes predictions by calculating genotype and phenotype data along with numerous weather factors. The other software is a machine-learning model that fills in missing plant and weather data for more accurate calculations.

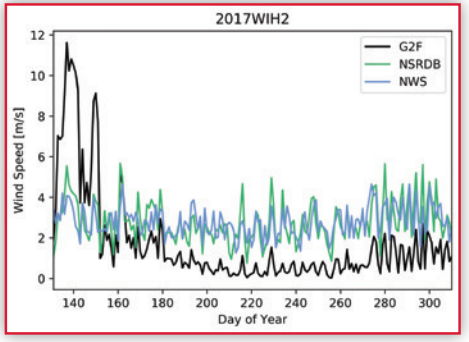
The team delivered a website that had numerous features, including special admin file upload permissions and the GxE model functionality. The website allows administrators to upload data files, run the models, and view the outputs of both models. The website also allows users without administrative privileges to select specific weather/climate factors before running the models on previously-uploaded data.

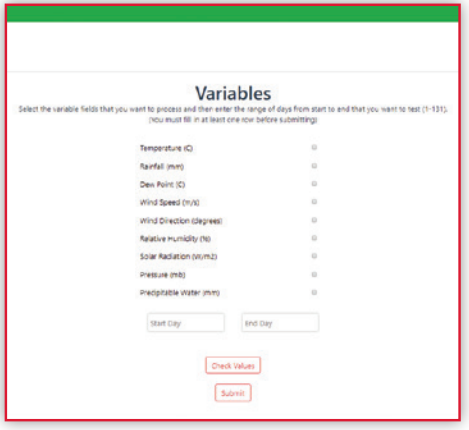
A large portion of the team's work involved backend tasks such as setting up Amazon Web Services (AWS) to host the website securely. The team used AWS to store the scripts for both models and the data uploaded by the website's administrators, as well as several APIs for user authentication and automated emails.

The website constructed by the team was created using a Vue.js framework, along with HTML and CSS. It communicates with AWS to authenticate user sign in, upload new files, and run scripts and models.

## THE TEAM

| | |
|---|---|
| Hallie Hohbein | Squad Lead and Product Manager |
| Anna Zhang | Development Manager |
| Joseph Carter | Developer |
| David Recic | Developer |
| Zoe Trautman | Developer |
| Juan Diego Herandez Jarquin | GxE Model Developer |
| Rubi Quinones | Computer Scientist and Engineer |
| Parisa Sarzaeim | Hydroclimate Data Scientist |

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Bonita Sharif**

Project: **CoderGaze Eye Tracking**

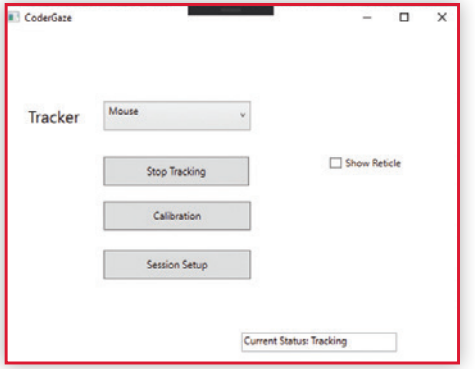
Developing CoderGaze presented many unique challenges throughout our year working on the project. The first challenge we faced with was determining the editor that would best apply itself for this application. Initially we intended to use Microsoft's Visual Studio Code, but we soon realized that they did not offer extensions enough access for our application. To combat this problem we used a more open source text editor: Atom. Atom provided solutions to many of our problems and allowed deeper access allowing us to create the desired functionality.

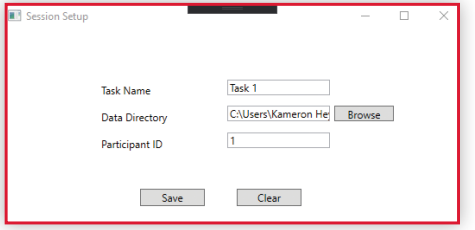
Another roadblock we ran into while working on this project is integration with the Eye Tracking labs brand new SmartEye Eye tracker. With other trackers we had frameworks and examples to build our solution from. With SmartEye the connection is not as straightforward. To resolve this challenge we set out to use our resources both within our team and outside of our team to find a solution.

One of the more abstract challenges we faced was how to visualize the data collected. To do this we called on Dr. Sharif's expertise and created many sample visualizations. We had to determine how to condense the data and what metrics were valuable in determining an interviewees coding ability. This challenge is one of the major challenges Dr. Sharif is tackling with her research.

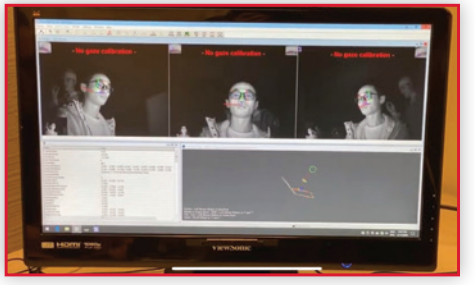
## THE TEAM

| | |
|---|---|
| Kameron Heyen | Squad Lead and Development Manager |
| Anthony Mcintosh | Product Manager |
| Sanat Bhandari | Developer |
| Jacob Cummings | Developer |
| Garret Ulmer | Developer |
| Zeyu Wang | Developer |







DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Mehmet Can Vuran**

Project: **Wireless Testbed**

This project is intended to create an intuitive web-interface to aid in the process of deploying experiments to the experimental wireless testbed around UNL's city campus. The interface's main functionality allows individual users to build experiments visually and verify that they are running correctly. It also provides the ability to manage users under yourself when it comes to accessing to certain radios and their given frequency range.

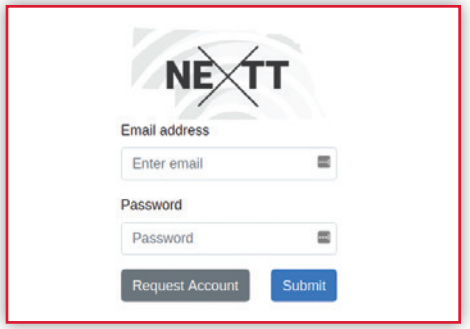
The team's solution consisted of three main portions that came together to provide a functional, yet intuitive, testbed interface: the UIand front-end components, the back-end logic, and Docker. The front-end implementation is built on the lightweight WSGI (Web Server Gateway Interface) web application framework known as Flask. Flask allows for an easy project structure that's built around Werkzeug and Jinja but doesn't enforce any specific dependencies or project layouts. This allows the developer to use the wide range of tools and libraries available today and not be confined to any real space.

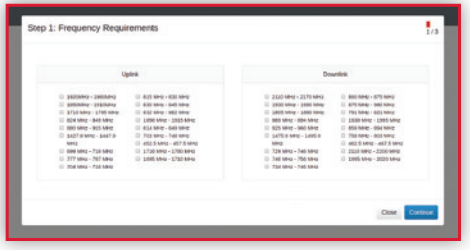
With the use of Flask, the back-end is built using Python 3. Interacting with SDRs (Software Defined Radios) requires some type of tool for communication. The team used GNU Radio to provide the interface between the back-end logic and the SDRs.

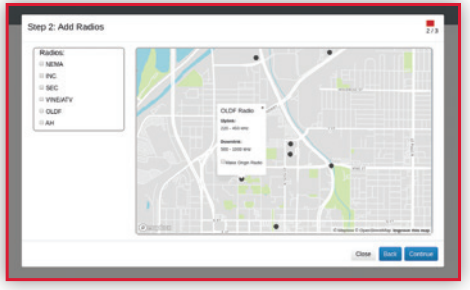
Orchestrating the running of experiments among a set number of radios proved to be a nontrivial task for the team. They implemented a FIFO (First in, first out) queue with priority to help determine when certain radios were available for the experiments that needed them. To provide the ability for many users to run experiments in parallel Docker was used. In addition to using Docker to deploy the interface, it was used to deploy the actual experiments. For example, each experiment can consists of multiple radios with different GNU Radio files to run. When an experiment is submitted and scheduled the back-end uses Docker to split that experiment into different containers for each of the involved radios. All the created containers for an experiment are still linked together with an experiment ID but they run apart from each other in parallel.

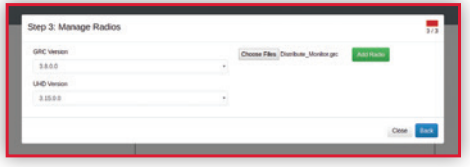
## THE TEAM

| | |
|---|---|
| Joshua Behlen | Squad Lead and Product Manager |
| Remington Brandenburger | Development Manager |
| Ethan Borden | Developer |
| Logan Hellbusch | Developer |
| Dominic Hezel | Developer |



DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Sponsor: **Marilyn Wolf**

Project: **Smart Home System**

The team was tasked with finding a way to create a smart home system using IoT sensors to help monitor adults with special needs as well as aid them by giving prompts. After two months of deliberation we decided the best way to solve this problem was to create a website which allowed for non-technical users to create monitoring scenarios. The user selects any number of sensor states to check for and then selects an action, usually a voice command to activate when the sensor states match the desired state. This sensor data is stored in a database for admins to access and look for anomalies in the data.

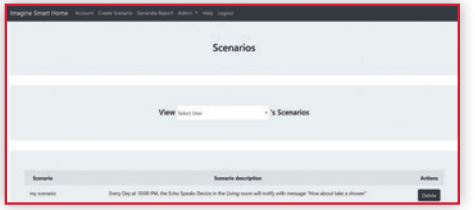
Our two biggest challenges we faced were figuring out what the end goal of our project and having our technology change half way through. Initially the project was simply setting up scenarios for users to implement in their house but realised this was not a sustainable method as there were too many possibilities. The challenge was then figuring out a way for the non-technical user to create complex code without ever seeing any that they created. The other major challenge was the technology we were using changed in January. We went from a code driven system to an API driven system. This initially created some issues as what we had previously created was no longer viable but creating a system around only API calls made the project significantly easier.

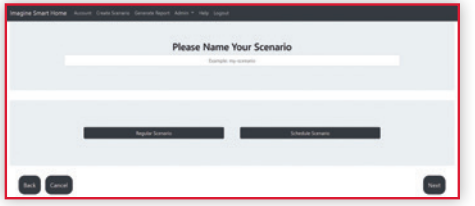
In the end we ended up creating a website where each household has their own account and the ability to create any scenario they can think of as well as setting up schedules. They also have the ability to contact the sponsor of this project in order to request new sensors or have maintenance on the current ones. We tried to make it as user friendly as possible as we expect them to navigate our website with no prior knowledge on how to use it. We also have a AWS Lambda server collecting the sensor data and pushing it into our database.

## THE TEAM

| | |
|---|---|
| Eric Le | Squad Lead and Product Manager |
| Alex Nigh | Development Manager |
| Tyreesh Boedhram | Developer |
| Emily Ewalt | Developer |
| Xingjian Shen | Developer |
| Tianrui Wang | Developer |





Sponsor: **DMSi**

Project: **Agility BOM Interface**

The team was tasked by DMSi to replace its spreadsheet system of maintaining Bills of Materials (BOMs) by creating a web application which would allow users perform a variety of functions on a BOM. First, a user should be able to create new BOMs. Second, the user should be able to quickly perform edits to each BOM and its data. Last, the user should be able to export each BOM into a spreadsheet form readable by Agility, DMSi's Enterprise Resource Software.

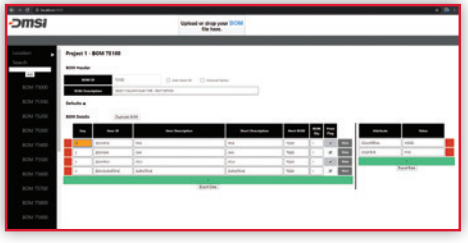
The delivered product allows a user to create new BOMs by importing them using existing BOM spreadsheets. The application reads the spreadsheet and stores each BOM and its corresponding details and attributes. A BOM can also be create directly within the application by simply making a new, empty BOM or duplicating an existing one. BOMs can be navigated between using a collapsible panel on the left, allowing the user to quickly find and change between BOMs. BOMs can be placed into user-defined categories within the navigation panel, to help organize the information.

The primary workspace is populated with the selected BOM's details, listing its header, item, and attribute data. Items and attributes can be quickly added, modified, and deleted through the interface. All BOM information and changes persist using an SQL database. Default values can be set for newly created items using a collapsible panel. This automatically populates the corresponding fields for each new item. If a single item is selected from the table, the attribute table will be filtered to display only attributes for the selected item. A selected item can also be viewed and edited independently in a separate page with a more complete list of fields.

The application also allows a user to export stored data into a new Excel spreadsheet. When this action is performed, any stored BOM details and attributes are organized and stored in the spreadsheet. From this point, it can be fed into and ran by Agility.

## THE TEAM

| | |
|---|---|
| Conner Hallett | Squad Lead and Product Manager |
| Alex Michael | Development Manager |
| Nasimul Gani | Developer |
| Zeyuan Kong | Developer |
| Paul Phillip | Developer |
| Ibraim Salinas | Developer |



GC IMAGE

Sponsor: **GC Image**

Project: **Chemometrics**

During this project, the team was asked to develop for and improve upon an existing codebase that uses machine learning to help chemical analysts to better understand and analyze samples and features of their data. In addition to learning and utilizing common machine learning classification and cross-validation algorithms, the team also dealt with data visualization and presenting results to the user.

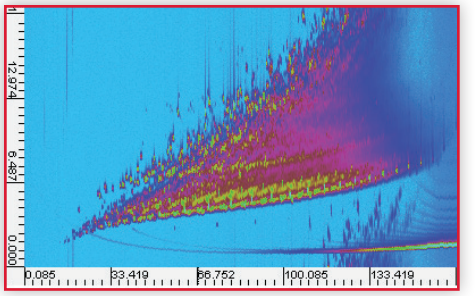
One of the key improvements the team focused on was using JUnit to create unit tests for each model component of the tool. In order to accomplish this, they also refactored the codebase into a model-view-controller (MVC) architecture to better separate which parts of the tool needed unit testing. After this addition, the team focused on updating and improving the machine learning capabilities of the software.

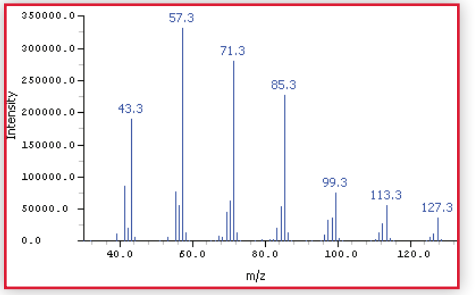
Firstly, the given codebase was designed heavily for binary classification (only two classes of data being compared at a time). The team worked to update the linear discriminant analysis (LDA) and k-nearest neighbor (KNN) classification algorithms and visualizations to use multiclass (three or more classes) data and convey multiclass results. Secondly, the team worked on adding new classification methods like quadratic and regularized discriminant analysis (QDA, RDA) and linear regression. And finally, the team worked on user configurations like data normalization and generalizing cross-validation techniques.

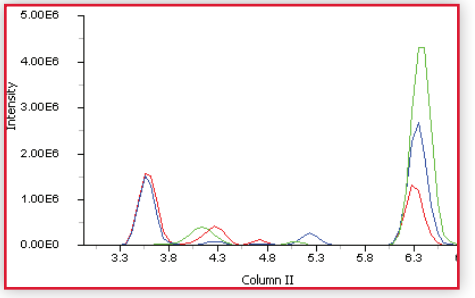
The team finished the project by giving the user a way to save and open their analysis so that they can come back to or send their results via an XML file. Beyond this, the team also developed a system testing routine for future developers as well as randomizing which data was used for training the machine learning model. The team worked on documentation both for the user and keeping in mind that development of the program will go back to the company.

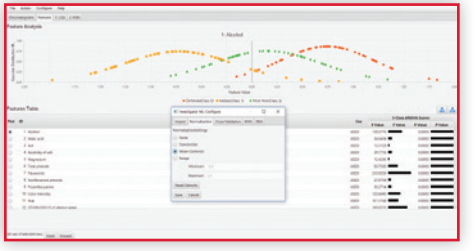
## THE TEAM

| | |
|---|---|
| **Logan Uhlir** | **Squad Lead and Product Manager** |
| **Spencer Stream** | **Development Manager** |
| **Zane Dush** | **Developer** |
| **Zoe Fu** | **Developer** |
| **Qikang Li** | **Developer** |
| **Richard Maina** | **Developer** |



Sponsor: **Hoffman Strategy Group**

Project: **Real Estate Analytics**

Hoffman Strategy Group owns considerable data related to real estate analytics. The Real Estate Analytics team's challenge was to transform this data such that it was aggregated, ordered, stored, searchable, and automated.

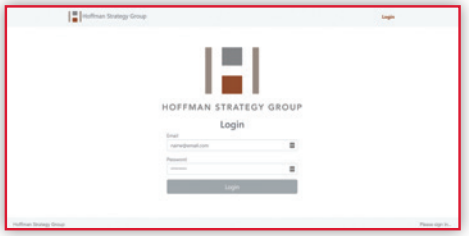
The Hoffman Strategy Group performs real estate analysis for customers ranging from businesses to cities. Say you owned the Starbucks chain, and you wanted to know where to put your next store. Hoffman Strategy could have told you that in spite of the number of coffee shops in and around the University of Nebraska-Lincoln, there was greater demand than supply, and you would have had a location for your next store. The team's challenge: Could they consolidate all of the partners' data on all of their projects—past, present, and future—into one searchable, comparable solution? The team was excited for the challenge.

The team researched the techniques, tools, and technologies best suited to the demands of the project. Armed with this research, they hammered out the requirements with their sponsors from Hoffman. The solution became a web application, hosted by Amazon Web Services, with a user interface written in JavaScript, leaning on the React and Redux libraries. The internal logic was C# code in the .NET platform. The storage was a database (PostgreSQL) on the AWS platform.

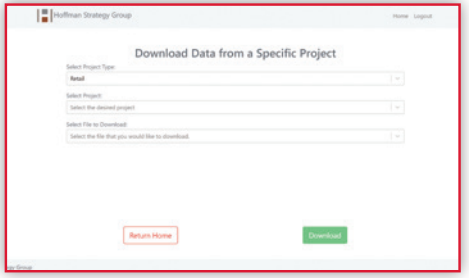
The Real Estate Analytics team piloted a new sub-team model: The sponsor-facing team specialized in parsing the contents of the Excel workbooks, transforming them into C# objects, and storing them in the PostgreSQL database. The internal team designed the user interface and worked on generating automated reports. Hoffman Strategy Group will use the team's solution to upload Excel workbooks, search and compare data, and generate reports.

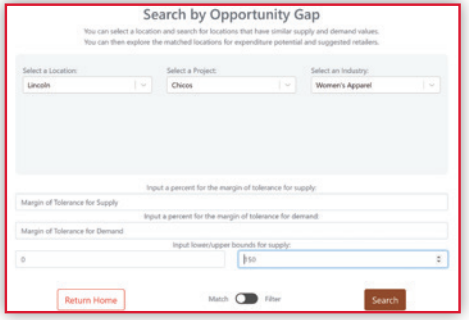
## THE TEAM

| | |
|---|---|
| Brooke Lampe | Squad Lead and Product Manager |
| Adrian Pilkington | Product Manager |
| John Forbes | Development Manager and Database Architect |
| Alec Schafers | Development Manager |
| Jack Rowen | Developer and Solution Architect |
| Adam Gray | Developer |
| Changsu Kim | Developer |
| Sam Neupane | Developer |
| Duc Phan | Developer |
| Matt Sichterman | Developer |







HOLLAND COMPUTING CENTER

Sponsor: **Holland Computing Center**

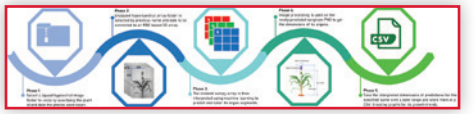
Project: **Plant Phenotyping**

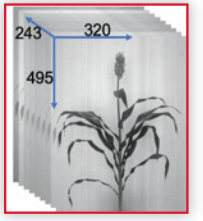
Schnable Lab is a plant genomics and phenomics research team started by Dr. James Schnable, Associate Professor in the Department of Agronomy & Horticulture at the University of Nebraska Lincoln. Due to experimenting with hundreds of living plants, their datasets have become quite large to store on Holland Computing Center's server, and their researching processes remain complex. The Plant Phenotyping Team developed a workflow that compresses the datasets used by Schnable Lab to allow for easier support on HCC's server, created a library that can extract specific files from the compressed dataset, developed another seamless workflow to simplify the researching methods used by Schnable Lab, and developed an image processing algorithm for extracting traits from organ segmented sorghum images.

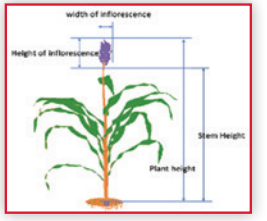
The team has developed two workflows. One workflow is dedicated to compressing Schnablelab's datasets. This workflow retrieves each of the sorghum image directories and converts them to a zip file. The other workflow is dedicated to simplifying Schnable Lab's researching methods, specifically for finding the growth curves of specific parts of the plant. This workflow's inputs are the compressed dataset files from the previous workflow. The workflow would begin by having jobs that would extract the hyperspectral images from the compressed files and convert them to numpy arrays using greenhouseEI, the python library that the team developed. Then, the numpy arrays are processed into organ segmented images that are used to extract traits from each plant during each day of an experiment. The organ segmented images for one plant are gathered and the workflow outputs a CSV file that has the plant height, stem height, inflorescence height, and inflorescence width for each day of the experiment using the image processing algorithm that the team developed. That data then goes through a job that creates a visualization showing the growth curve. Both of these workflows are implemented using Pegasus Workflow Management System.

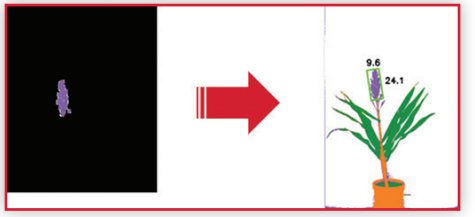
## THE TEAM

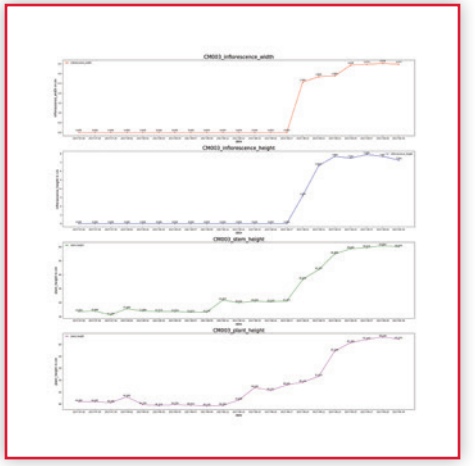
| | |
|---|---|
| **Yinchao He** | **Squad Lead and Product Manager** |
| **Zhenghui Su** | **Development Manager** |
| **Collin Cornman** | **Developer** |
| **Phillip Nguyen** | **Developer** |
| **Yifeng Yu** | **Developer** |





MADONNA
Rehabilitation Hospitals

Sponsor: **Madonna Rehabilitation Hospital**

Project: **SMART**

The Madonna Rehabilitation Hospital Senior Design team has a unique challenge of working on one of engineering's cornerstone project archetypes, an embedded system. The primary objective of this project is to create a system that a clinician can use to wirelessly collect and observe health-related data in real time. This system requires a variety of different software and hardware components to complete the task outlined above.

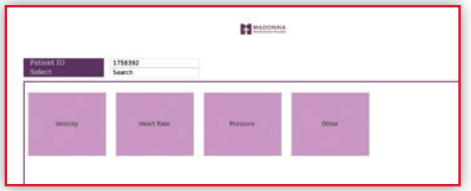
The sensors are the marquee hardware components of the project. We have constructed our own proprietary sensors by combining several open-source hardware modules with custom code. Most sensors consist of a sensor module, ESP32 Thing board, and a WiFi broadcasting chip. Some use Bluetooth to interface with their sensor module. The sensors are powered via a USB input.

The Web application is the client-side application that the clinician will use to monitor the results of the session in real time. The clinician will select one or more tests and attach the relevant sensors on to their patient. The data collected by the sensors will then be stored in the database and be sent live to the Web application. Upon completion, the clinician may permanently save the recorded session's data or discard it.

We have created an SQL Server database to accommodate the expanse of data the system may one day need to store. We utilize stored procedures to retrieve information from the database that has been recently collected by the sensors.

## THE TEAM

| | |
|---|---|
| **Andrew Buckwalter** | **Multi Team Squad Lead and Product Manager** |
| **Josh Martin** | **Development Manager** |
| **Bryan Borer** | **Hardware Developer** |
| **Alex Chmelka** | **Hardware Developer** |
| **Dennis Feng** | **Hardware Developer** |
| **Joey Novotny** | **Hardware Developer** |
| **Tommy Boswell** | **Software Developer** |
| **Ben Morris** | **Software Developer** |
| **Ryan Witkowski** | **Software Developer** |
| **Shichen Zhao** | **Software Developer** |



Sponsor: **Mystic Rhoads Productions**

Project: **baldorf**

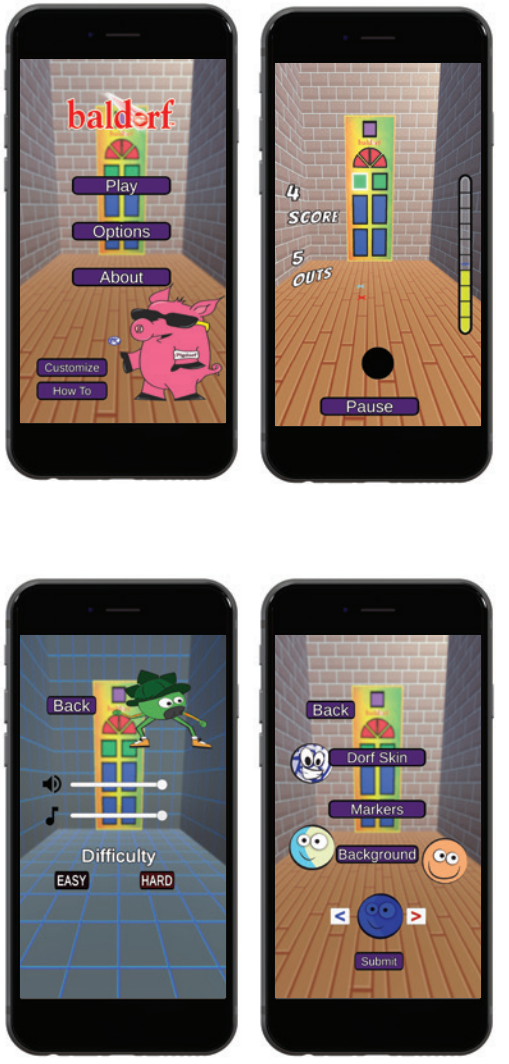
Our team was challenged to take the real life game of baldorf and implement it into an application that works with Android and iOS devices as well as on desktop. Our solution was to make an application that will include all rules present in the real life game of baldorf. The application allows the user to experience an enjoyable game of baldorf through the convenience of their mobile devices and computers, providing customization options and conveniences that give mobile baldorf its own sense of fun and encourages kids to go out and play the real life version of the game.

To begin tackling the challenge, we were required to have an in-depth understanding of how the game of baldorf works. We watched videos and read the rules of baldorf in order to list the requirements of the game. Our team also physically played baldorf to completely understand the mechanics and flow of the game. Once we had a solid list of rules and requirements the team spent a couple weeks learning how to use our software of choice, Unity. After learning and designing we were ready to start creating the foundations for the application and implement the rules. Although as development continued some of the original game rules had to be modified to fit the constraints that mobile devices bring.

The development platform we used to build our application was Unity. Unity provided the team with a physics engine, quick to learn game design tools, as well as the ability to easily export the game between all necessary platforms. Our process began with creating various menu screens for the user to navigate through the application. The user is able to start a game, change their settings, customize their gameplay, and read about Mystic Rhoads Productions. With our foundations laid out, we implemented gameplay mechanics such as physics, collision, rule enforcement, score counting and more. The application also has an interactive tutorial for new players to learn how to play the game. There is also a multiplayer feature for users to locally play with others. A lot of the design decisions our team had to make were based off the large amount of user feedback we received. One of the most important aspects of the game to the team was we wanted it to be a fun experience for all and bring awareness to Mystic Rhoads Productions charity.

## THE TEAM

| | |
|---|---|
| **Syrus Bomberger** | **Squad Leader and Development Manager** |
| **Mac Ozanne** | **Product Manager** |
| **Christian Berck** | **Developer** |
| **Kevin Nguyen** | **Developer** |
| **Joseph Storf** | **Developer** |



Sponsor: **Nebraska Family Dentistry**

Project: **SchedAssist**

The product we set out to create for Nebraska Family Dentistry incorporated a goal to streamline and clear up the scheduling process for dental appointments. The existing solution we are replacing presents itself in a way that often confuses new and existing patients for the company, leading to lower productivity where it could matter most. As such, we developed software that will take over how they manage their patients as well as the schedules for each provider. Our solution is comprised of three pieces to the puzzle: a mobile and web scheduling application, a server to handle incoming appointments and location schedules, and a portal for administrators to access to manage their location.

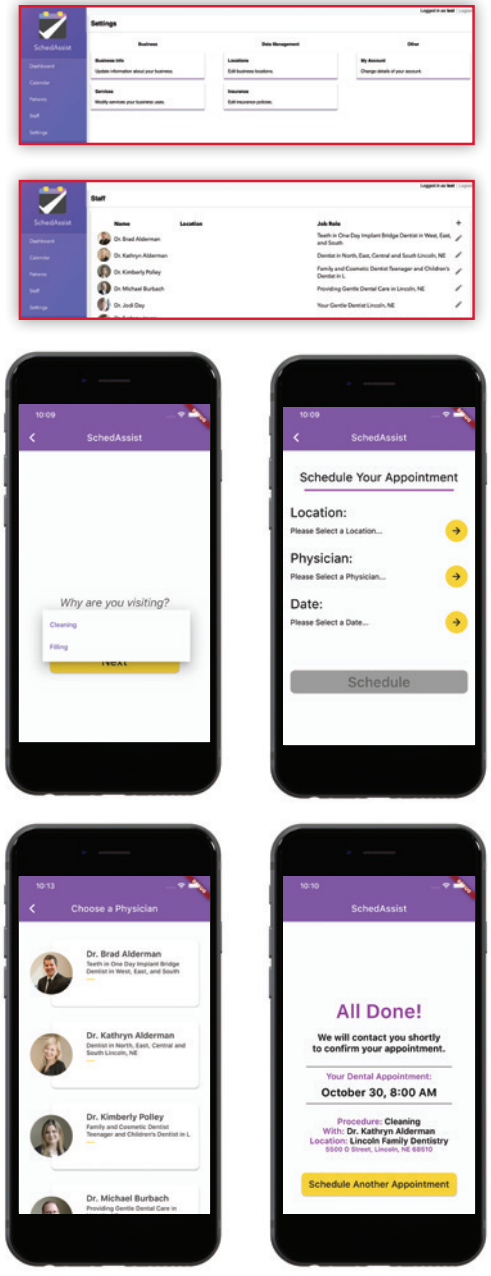
The scheduling application is created using the framework from Google known as Flutter. This simplifies the development process to where we are able to create one consistent product, as opposed to two or three, that will work on iOS, Android, and your browser. An improved benefit we accomplished was improving the flow of a patient wanting to schedule with a location for a specific service. Any request for a new appointment will be sent through the server, which will let the user know what times are available for any given criteria: the provider, the location, and the day.

The administration portal will allow for a cleaner display of an office's information, such as schedules for all of the providers. This allows administrators to create schedules for physicians, view patient appointments as well as patient information. Administrators are also able to set other relevant information such as locations, location information, types of operations provided, etc.

The primary goal was to develop this system for Nebraska Family Dentistry, but design it in a way so that future development on the project is easier when they want to give other practices the ability to use SchedAssist.

## THE TEAM

| | |
|---|---|
| Cole Beiermann | Product Manager |
| Brandon Huettner | Development Manager |
| Hassan Abdelsamad | Developer |
| Colin Cummings | Developer |
| Brett Middle | Developer |
| Vimal Roy | Developer |



Nebraska Book Company

Sponsor: **Nebraska Book Company**

Project: **Book Buyback System**

The team was tasked with porting the functionality of the existing program to a modern platform using modern technologies. Nebraska Book Company recommended using .NET framework so that the code base would be using a modern language that offers plenty of existing external libraries and packages. The team decided on developing a Winforms application in Visual Studio using .NET framework 4.7.2 in C#. Winforms is a noticeable visual improvement over the previous C legacy code, not only being more aesthetically pleasing, but also allowing for practical GUI elements to be added with ease. In addition to GUI, we included hotkeys as per the sponsor's specifications, to allow for experienced users to use the system as quickly as they could press their keys.

The team also designed and built the system's data layer from scratch, as the new program would be using totally new database tooling. Care needed to be taken to keep database operations fast when dealing with 100,000+ book records. In some cases, database operations are performed asynchronously (separate from the main thread) to minimize stutter in the program's UI. The team decided to use SQLite for database functionality since it uses a single file on the local system to contain an entire database. This solution was chosen because book buybacks may take place in a location with no internet connection.

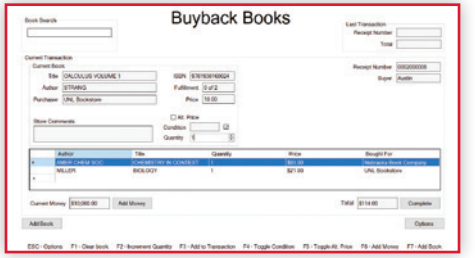
Books are searchable through any number of attributes: title, author, ISBN, etc. Fuzzy searching was implemented so as to make searching for books more convenient for the user. Different purchasers of books are able to be added and manipulated depending on the order the user prefers. Purchasers that should receive books first can be moved to the top of the list.

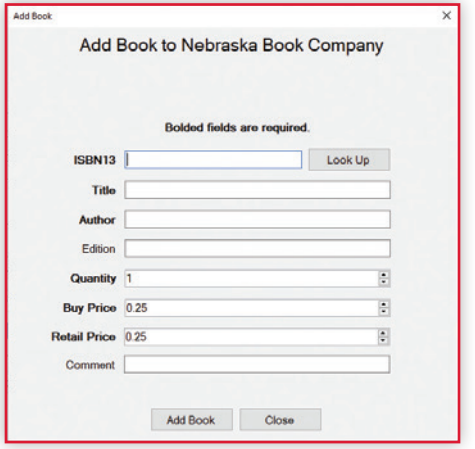
There are various reports that the user can generate, creating a csv file in a chosen directory. These can range anywhere from books purchased and allotted to different purchasers during a certain day or over an entire buy session. This allows the user to easily allocate books purchased during a buy session to the appropriate purchaser without any other intermediate steps.

## THE TEAM

| | |
|---|---|
| Ryan Schmid | Product Manager and Squad Lead |
| Austin Asmus | Development Manager |
| Ben Galusha | Developer |
| Miracle Modey | Developer |
| Dalton Rooney | Developer |
| David Snavely | Developer |





NEBRASKA
Good Life. Great Connections.
DEPARTMENT OF LABOR

Sponsor: **Nebraska Department of Labor**

Project: **Labor Market ML**

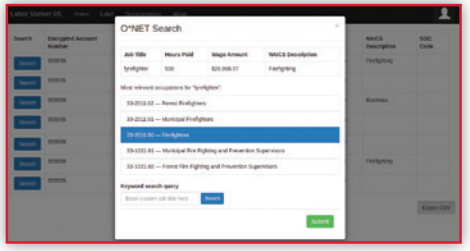
The primary objective of this project is to create a secure Machine Learning based web application to automate the task of labelling job titles with correct Standard Occupational Classification (SOC) codes while considering other features such as North American Industry Classification System (NAICS) description as well. The Nebraska Department of Labor deals with sensitive yet repetitive information on a daily basis. To better utilize time, effort, and other resources spent on doing this, we hope to deliver a product that is convenient to use, easy to modify and update, and secure.

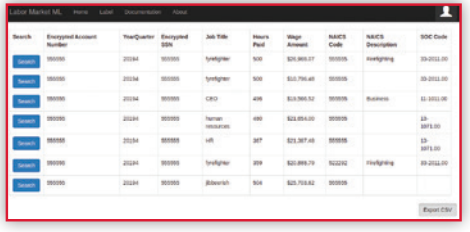
Creating our solution comprised of three parts: data annotation, Machine Learning solution, and web application. To encounter the challenge of data annotation, a python script was written to sanitize the data and a web application was developed to call O*NET API to recommend relevant SOC codes. This labelled data was then used to train and test the model.

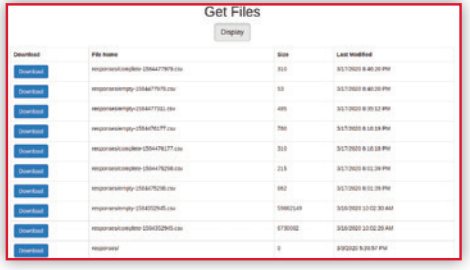
The Machine Learning model for this project was deployed using Amazon Comprehend. The solution aims to deliver not only competent accuracy, but also confidence scores for each entry which is essential to the usefulness of the project. The confidence scores ensure that all the entries correct and give the user the opportunity to correct any entries the were mislabeled due to low confidence scores. The solution has been developed keeping in mind that the SOC codes are constantly revised and updated, and the model might need retraining.

## THE TEAM

| | |
|---|---|
| Jacob Hansen | Product Manager and Squad Lead |
| Zach Hytrek | Development Manager |
| Sanyam Agrawal | Developer |
| Aniruddh Saxena | Developer |
| Tanima Shrivastava | Developer |
| Michael Wilson | Developer |



Sponsor: **Nebraska Environmental Trust**

Project: **Grant Management System**

For the Nebraska Environmental Trust Staff, who need to validate that certain criteria are met for each grant and track project information, the grant management system is an information management system that leverages modern tools and technologies, reduces waste of resources and time, and increases efficiency and accuracy; the team has introduced new features to the existing system that admins can use to manage applications and active projects. Features have also been introduced for the project officers of awarded projects, allowing them to track information for their grant(s) and project(s). These features are focused on recording equipment and land purchased to fulfill project requirements and tracking the allocation of grant funding.

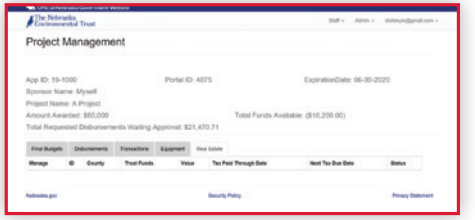
One set of feature the team delivered was the ability to manage equipment records for a project. Project officers now have the ability to submit information regarding any equipment purchases required for their projects, as well as the proof of insurance for all listed equipment. NET administrators are able to search, view, and comment on these equipment purchases. They can also approve or reject the submitted records if necessary. The development team incorporated these features into the existing grant management system, allowing users to take advantage of these new options without having to leave the system with which they were already familiar.

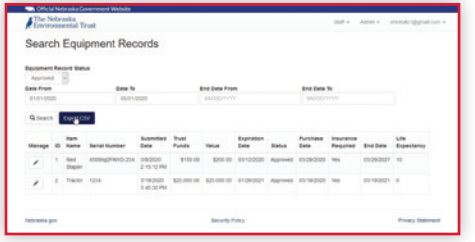
Another major milestone the development team delivered was the ability to manage purchased real estate for a given project. Project officers are able to submit records of any land purchased with their grant, manage lands associated with their projects, and track any taxes due for all land purchases. NET administrators can then search, view, and track these records in a similar manner as equipment records. One again, these features have been added to the existing grant management system; users can stay within familiar pages, but now have more powerful options available to them.

The development team was able to add these features as well as make other contributions to the system's documentation, testing, and databases. All of these additions allow both project officers and administrators

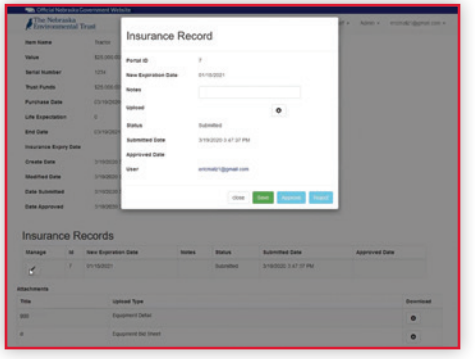
## THE TEAM

| | |
|---|---|
| **Ethan Bütt** | **Squad Lead and Development Manager** |
| **Maggie Harder** | **Product Manager** |
| **Kushagra Kapil** | **Developer** |
| **Nate Lickei** | **Developer** |
| **Eric Matz** | **Developer** |
| **Kyle Stolle** | **Developer** |







PAINLESS PREP

Sponsor: **Tom Thompson, Mike Schmitt,Rob Gibson, John Barnhart, Greg Daake**

Project: **Painless Prep**

For many painters, manually masking windows can be a tedious and time-consuming process. When on jobs with large numbers of window panes and French windows, this task can take hours. The Painless Prep team was tasked with creating a solution to this inefficient process. The team's solution to this was tackled on two fronts. Developing a new use of technology to precisely measure the windows to print out laser-cut covers for them that replace the masking process was one front. The other was creating a mobile app to organize all of the painter's jobs and orders.

The largest task the team faced was being able to measure a window within 1/16th of an inch using a phone camera. Current measuring programs on phones have a margin of error upwards of 3 or 4 inches. The team's solution to this was quite unique. The inspiration was originally adapted from calibration lines used by bombers in the Air Force. The team developed a reference objected that had specific measurements. From there, the team adapted a visual recognition software to detect the corners of the reference object and the corners of the window frame. After adjusting for distortion and skew, this turned the complex problem into a simple cross multiplication problem.

In order for this incredible process to be fully utilized, the team created a fully functional, cross platform, mobile app to host it. The Painless Prep app allows users to create new jobs, and use this process to populate the dimensions of windows into the order for the user with a few clicks of a button.

Combining these two things allowed the team to create a simple and useful tool for painters everywhere.

## THE TEAM

| | |
|---|---|
| **Brennan Roberson** | **Squad Lead and Product Manager** |
| **Gage Zitler** | **Development Manager** |
| **Youssef Fathy** | **Developer** |
| **Dominic Mai** | **Developer** |
| **Anqi Zhao** | **Developer** |
| **Jake Modica** | **Marketing Bro** |

Sponsor: **Henry German**

Project: **Regular Phil Brands**

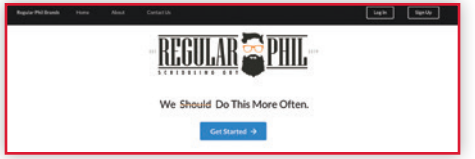
The team was tasked to create an application that helps create and manage social gatherings and get-togethers. Our solution for this is a fully-functional website that allows a group of friends to easily plan an event together and figure out a date, time, location, and activity that works best for them. The application behaves like a virtual assistant, and makes it easy to be flexible.

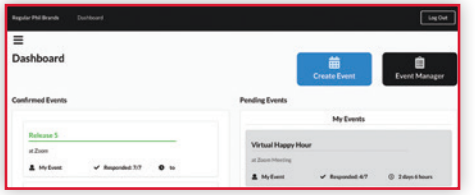
The solution our team created to meet this problem was a responsive website using React.js as our frontend and Django as our backend. We chose to use a website because it made it much easier to integrate our service onto every platform, and allowed us to use text messages rather than create our own messaging app. We worked out a contract between our sponsor and the Bandwidth API to handle sending and receiving text messages, which is crucial to our service.

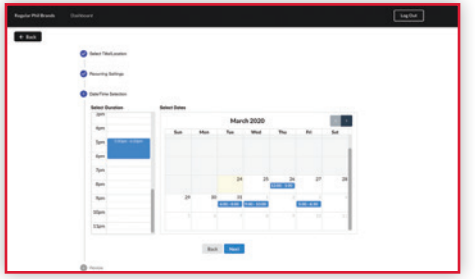
Here's how a user interacts with the website: The coordinator would first start by creating an account and logging into our website. Once they have done that, they will be able to see their own dashboard, where they can create a new event, manage their existing events, or delete an event that they no longer want to happen. When a coordinator creates an event, they will be able to create a list of locations, titles, and times they want their friends to vote on. Once an event has been created, the user will receive a text message with a link to the poll page, a page which contains all of the event information they just created. The user is instructed to forward this link to a group chat with their friends and the Regular Phil phone number. Our backend will receive this message and associate each number in the group chat with that event. Once a friend clicks on the poll page link, they will see their number in a list of numbers. If that friend had an account with us previously then their first and last name will also appear. Next, the user is shown a calendar view with available dates that they can vote on. Each date has four choices: no, yes, preferred, and maybe. The timed tasks keep track of who has voted and who has not, which will send out reminders to the group chat after certain periods of time. Once everyone has voted on the event or the three day voting period has expired, we tally the votes and decide a winner for the location, title, and date for that event. The group is then sent a text message reminding them when their event is a few times before it is scheduled to happen.

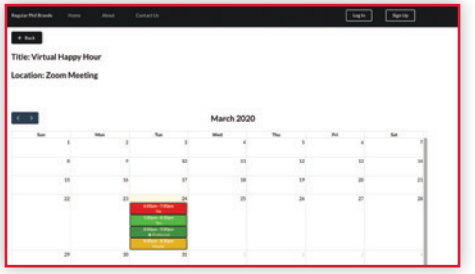
## THE TEAM

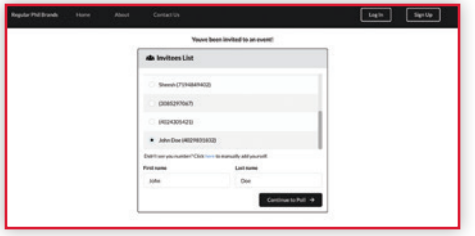
| | |
|---|---|
| Max Danley | Squad Lead and Product Manager |
| Peyton Tanzillo | Development Manager |
| Taher Ahmed | Developer |
| David Garza | Developer |
| Rinish Reddy | Developer |
| Jesse Reyes | Developer |



Sponsor: **The Bay**

Project: **Facility Management Tracking**

The Facility Management Tracking team was given the unique challenge of creating a unified solution to easily manage, track, and report on the usage of The Bay's facilities. The problem with the previous solution was that each system used had no way of communicating with one another. This meant more time and effort was needed to create usage reports as well as introduced more human error. As such, the team developed a centralized system designed to replace all of the old systems used by The Bay. This was done through the use of a web application, RFID scanning, and custom reporting.

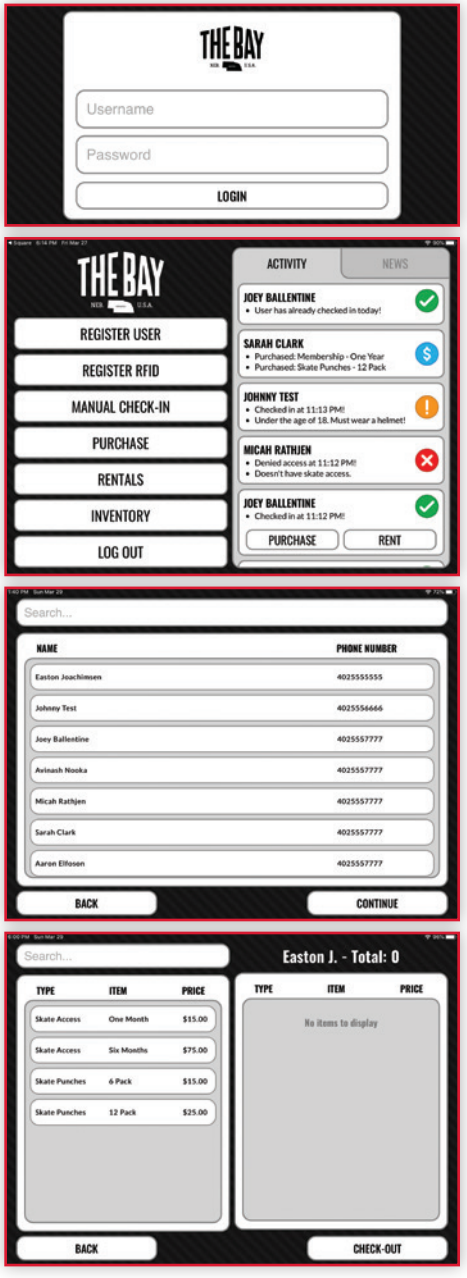
In developing the web application, the team used a full-stack JavaScript approach. At the same time, since the web application that needed to interact with Point-of-Sale services such as Square, the team created an iOS app. This enabled the web application to seamlessly interact with other iOS applications without the awkwardness brought about from simply using a standard web browser. To further improve the overall feel of the solution, both the iOS and web applications were designed for usage primarily on iPads.

Another novel part of the solution developed by the team was the use of RFID scanning. Previously, The Bay used a combination of systems (one being pencil and paper) to understand who checks in to use their facilities. With the use of RFID, users are now able to simply scan a card and the system will verify if a user is able to use certain facilities. This resulted in a streamlined user interaction between customers and staff members.

Through all of these simplifications, however, there needed to be a way to understand what kinds of users were using facilities at The Bay. Previously, this was done by accessing each of the previously utilized systems' reporting tools. This again meant more time and effort needed to be used to collect and summarize data than simply having it readily available. The solution developed by the team was to create an admin console that consolidates all of this information which is able to easily customize what kinds of reports need to be generated.

## THE TEAM

| | |
|---|---|
| Avinash Nooka | Squad Lead and Development Manager |
| Joey Ballentine | Product Manager |
| Sarah Clark | Developer |
| Aaron Elofson | Developer |
| Easton Joachimsen | Developer |
| Micah Rathjen | Developer |



CENTER ON CHILDREN, FAMILIES, AND THE LAW

Sponsor: **Center on Children, Families and the Law**

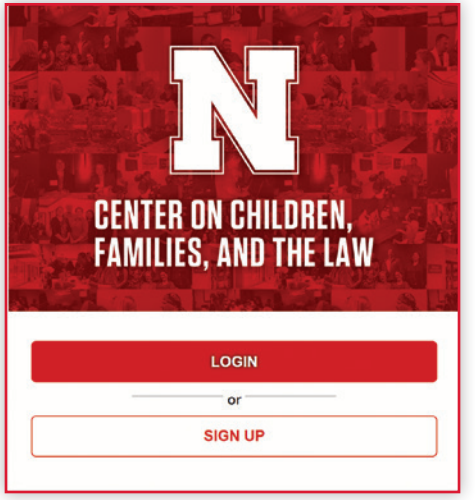
Project: **Interactive Training Application**

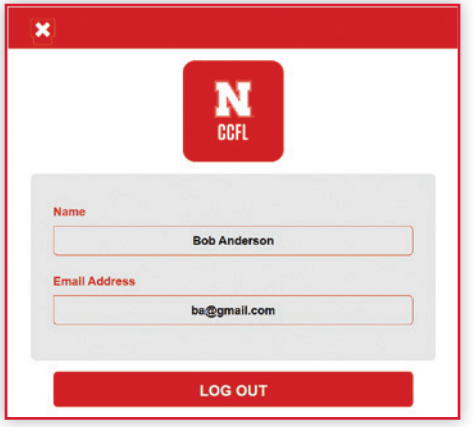
UNL's Center on Children, Families, and the Law (CCFL) provides training each year to approximately 3,500 child welfare specialists, judges, teachers, attorneys, law students, probation officers, and community service providers focused on strengthening Nebraska families and protecting children. For more than 30 years, CCFL has worked closely with agencies to customize curricula and develop empirically supported evaluations of trainee knowledge.

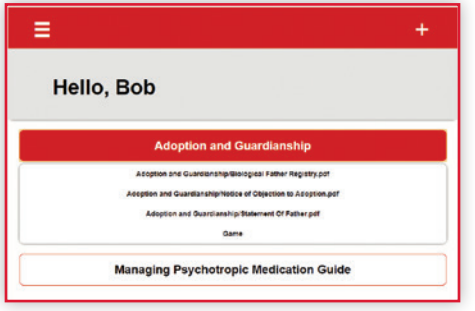
Many are dependent on this information that is subject to change frequently, so a tool was needed to support easy distribution of frequently changing information. After analyzing the sponsor's needs the senior design organization developed a progressive web application capable of separating and serving the CCFL's training documentation in a more timely and organized matter. The application supports an instant refresh on the addition of edit of training material so that trainees may more easily access the documentation required of their jobs.

## THE TEAM

| | |
|---|---|
| Jacob Petersen | Main Team Squad Lead and Product Manager |
| Mark Hollis | Main Team Development Manager |
| Zhi Chew | Main Team Developer |
| Raksharth Choudhary | Main Team Developer |
| HengYi Hu | Main Team Developer |
| Fatima Mohammed | Sub Team Squad Lead and Product Manager |
| Geigh Zollicoffer | Sub Team Development Manager |
| Dane Gallentine | Sub Team Developer |
| Jessica Wheeler | Sub Team Developer |



AGRONOMY AND HORTICULTURE

Sponsor: **Agronomy and Horticulture**

Project: **Invasive Species Impact Analysis Tool**

The Department of Agronomy and Horticulture tasked the team with creating an application for creating real-time visualization representing survey response data, primarily on the impact of invasive species on ecosystems. The goal of the project was to find a better way to inform and communicate survey results to policy-makers and community members in order to influence conservation policy. In the past, the sponsors depended on Qualtrics and R scripts to gather, clean, and summarize the data before creating the visualizations. The method was time-consuming and restrictive. An efficient and robust tool was needed to automate the tasks.

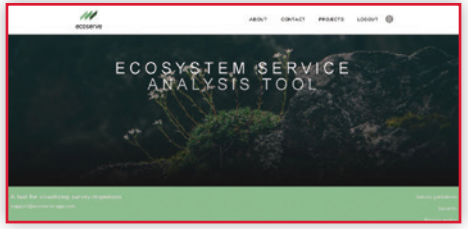
The solution created is a web application that allows users to create account that links to their Qualtrics account. The surveys under the Qualtrics account are automatically pulled to the web application, allowing users to choose which questions from the survey they would like represented by a graph, and the type of graph for each. The process of creating the web application can be grouped in 3 parts: front-end development, back-end development and visualization development. The application used a MEVN (Mongo, Express, Vue, Node) stack primarily, but utilized as many as 30 different services, libraries, frameworks, etc. to complete the project successfully.

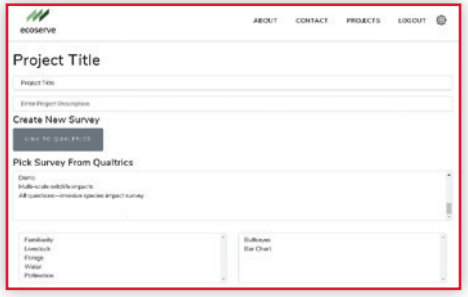
The front-end of the web application was built using Vue.js for a lightweight and robust solution. The web application is hosted on AWS using AWS Elastic Beanstalk. Authentication of the application is taken care of by Amazon Cognito service. The team chose D3.js for the creation of the data visualizations. The team worked with the sponsor to determine which options for visualizations and format of survey questions would be accepted by the application, to ensure consistent quality for all users.

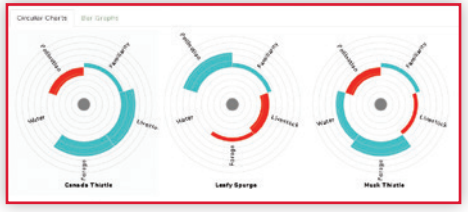
After the user creates an Ecoserve app account, linked to their Qualtrics account, they are able to create a new project. During project creation, the user provides the name and description of the project, links a survey, and specifies which, if any, visualizations will represent each question block from the survey. The project data is saved to a MongoDB cluster where survey data is also stored. The user is able to edit the type of visualization and download the graphs for use in reports or other educational purposes.

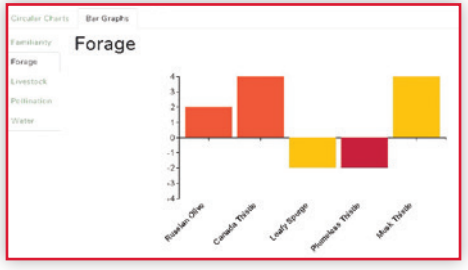
## THE TEAM

| | |
|---|---|
| Christopher Burbach | Squad Lead and Development Manager |
| Alexis Polzkill Saltzman | Product Manager |
| Vy Doan | Developer |
| Stephen Ralph | Developer |





INFORMATION TECHNOLOGY SERVICES

Sponsor: **University of Nebraska ITS**

Project: **IT Asset Tracker**

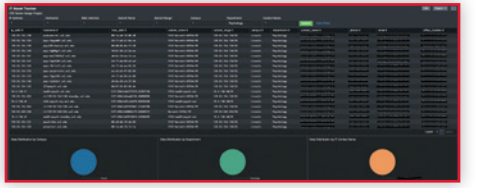
The team started the project by researching various technologies that should be integrated into our Splunk dashboard. Specifically, there was a large amount of data that should be presented to the user from many different sources (such as Efficient IP (EIP), Tenable, and Microsoft Active Directory). At the beginning of the project, the implementation method was not clear, so the first thought was to make API calls using Python scripts to import the data into Splunk directly from these technologies. Over time, the team was able to determine the specific needs of the sponsor.

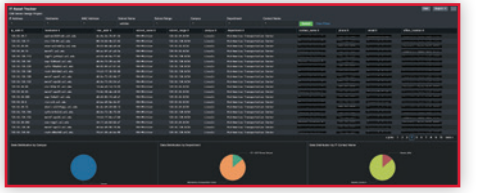
The team figured out that using EIP was sufficient to import all the necessary data into Splunk and present it in a user friendly interface. So, as a result, the team started to search for a way to make EIP communicate with Splunk directly. During this phase of development the team members needed access to the EIP data, so the ITS team had to install the University VPN (virtual private network).

After collecting all the device information, the team found that there was no link between the device's subnet and the device's IT contact person. This required the team to manually link each subnet to a University department, and then to an IT contact through the use of a "Rosetta Stone" document. The team took a large amount of time working with the ITS security team to determine which department was responsible for each of the approximately 1000 subnets on the UNL campus. In the end, the team was able to complete the sponsor requirements for the project in a timely manner, and also added some additional features to the Splunk dashboard after receiving feedback from testing.

## THE TEAM

| | |
|---|---|
| Nathan Asselin | Squad Lead and Development Manager |
| Vu Mai | Product Manager |
| Al Farooq Al Salti | Developer |
| Micheal Baumfalk | Developer |
| Elisa Peng | Developer |
| Yongshun Zhou | Developer |





Sponsor: **UNMC-College of Public Health**

Project: **Healthy Eating App**

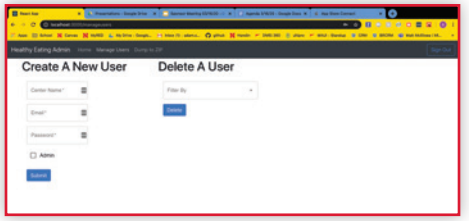
The goal of the Healthy Eating App project was to create a system that can gather data for researchers trying to help improve family child care programs. Family child care programs take place in the home of a non-relative of the child rather than a commercial facility. There are two main components to the project that work together to form a final solution. A mobile application to help with data collection for researchers trying to evaluate key factors in family child care programs. A web application to provide researchers with an easy place to view all data collected, along with managing the accounts of participants.

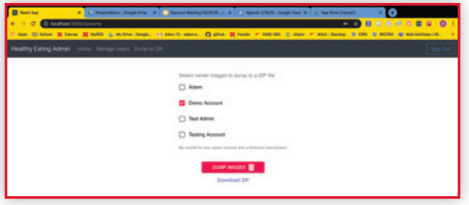
The final mobile application is available in both the Google play store and Apple App store, with compatibility across many types of mobile devices. The application has a simple user interface to take a picture, add a description and submit both. Users also have the ability to view past submissions and edit them as necessary. The final web application gives researchers access to all submissions, control over creating and removing accounts for participants, and the ability to download images from certain users to a zipped file.

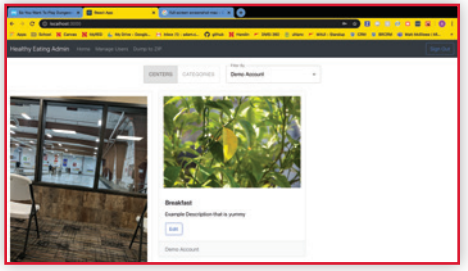
The solution created provided a simpler way for researchers to gather data which can be used to increase the better the family child care programs. Additionally, any new information gathered can help in the growth of knowledge in the field and with those teaching to give better advice on how to implement the best practices for family child care providers.

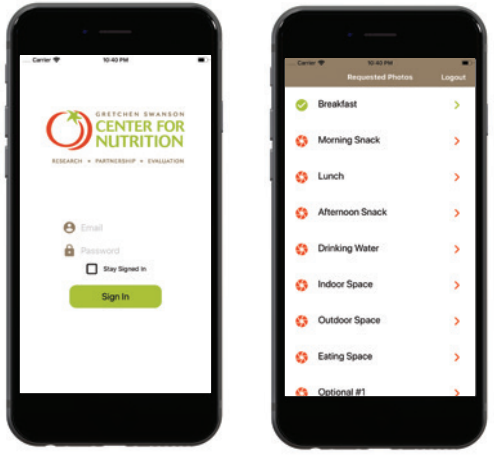
## THE TEAM

| | |
|---|---|
| Adam Schlichtmann | Squad Lead and Product Manager |
| James Fox | Development Manager |
| Tristan Attebery | Developer |
| Wyatt Chandler | Developer |
| Nicholas Lawrence | Developer |







UNMC
MUNROE-MEYER INSTITUTE

Sponsor: **UNMC – Munroe Meyer Institute**

Project: **HABIT-VR**

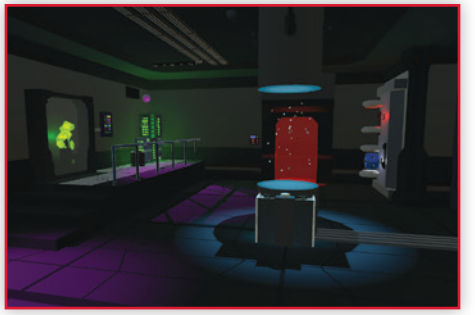
Cerebral Palsy (CP) is the third most common pediatric neurological diagnosis in the United States and is caused by an insult to the brain during early development. Children with CP often exhibit motor deficits in areas such as reduced mobility, reduced sensory & motor processing, and difficulty with motor learning. While there are techniques developed to resolve the issue of CP such as surgery and orthotic intervention, these techniques unfortunately do not have a consistent or high rate of success for improving mobility or coordination.

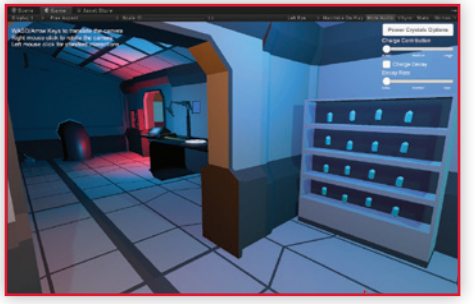
One technique that has become more successful is Hand-arm bimanual intensive therapy (HABIT) which operates as physical therapy that induces specific motions using both arms to improve the motor capabilities. Unfortunately, physical therapy is a grueling task for particularly the patient and has little in the form of any way to encourage engagement. A recent research topic of this area has been the use of VR games to capture the physical movements, but also provide extra enjoyment and induce engagement. Our project was spearheaded with this in mind.

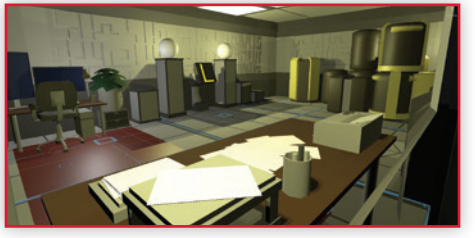
Specifically, our project's task was to develop a narrative driven escape room filled with physical puzzles that would emulate the normal physical therapy movements. Our team took this goal and grew it into a far greater project that furthered each requirement beyond expectations. A single escape room became many, each with a single game. A small scale narrative became a cohesive one, including a dedicated villain to fight and superior to respect; each with their own voice acting. Each game went out of its way to be both visually appealing, exciting, and remain therapeutic. Even therapists have a say through a user interface visible only to them in which they may modify the game as it runs. With a taskforce of ten, we were able to assemble each piece and bring them together into one single game made to deliver at least six hours of fun and engaging therapy to children over the summer.

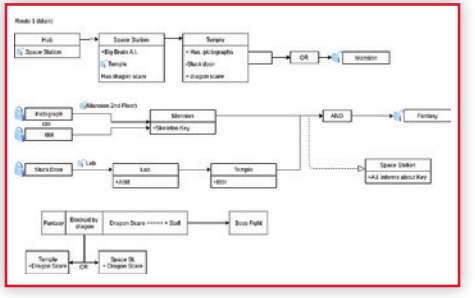
## THE TEAM

| | |
|---|---|
| Ethan Penn | Squad Lead and Product Manager |
| Ryan Soto | Development Manager |
| Grant Bosley | Developer |
| Kyle Hadwiger | Developer |
| James Murray | Developer |
| Chase Pearson | Developer |
| Jeron Robke | Developer |
| Demetrius Sigowa | Developer |
| Jared Svoboda | Developer |
| Brock Williams | Developer |









Sponsor: **USDA NRCS**

Project: **wetland-delineation**

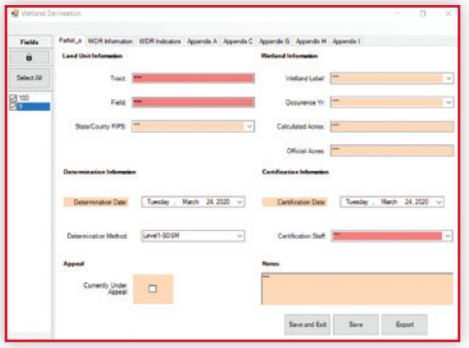
The USDA NRCS wetland-delineation Senior Design team was tasked with creating an ArcMap add-in to facilitate data entry by team members, perform calculations, and ensure data integrity. The Senior Design team delivered a tool which streamlined the wetland delineation process for the NRCS team. The tool also included features like importing data from ROP points, delineating multiple fields at the same time, and showing when data between multiple fields was conflicting.

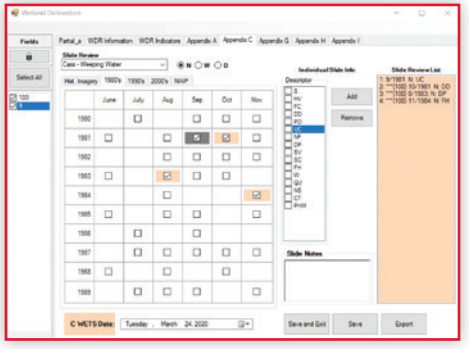
The Senior Design team decided to create a Windows Form like the old add-in that the NRCS provided. Since no one on the Senior Design team had created a Windows Form before, learning .NET, reviewing the old tool, and creating mock-ups of the new tool was what the team accomplished during the first release.

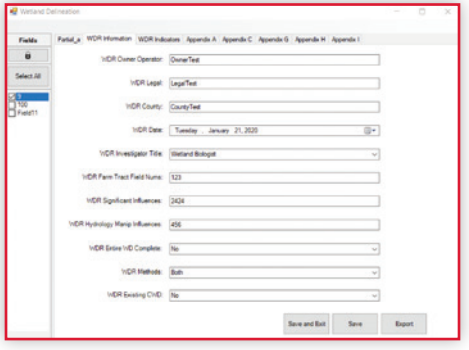
Since facilitating the data entry for the NRCS team was one of the main priorities, figuring out the layout of the tool was one of the biggest challenges the Senior Design team faced. The team met with the sponsors weekly after the mockups were created to refine the tool's layout and receive feedback from the end users. The tool was also given to the NRCS team during later releases to test functionality and get suggestions.

## THE TEAM

| | |
|---|---|
| Samir Kashyap | Product Manager |
| Parker Siemek | Development Manager |
| Jared Breitkreutz | Developer |
| Braydon Clyde | Developer |
| Reid Stagemeyer | Developer |







# SENIOR DESIGN STUDENTS

Hassan Abdelsamad
Sanyam Agrawal
Taher Ahmed
Arreya Ahrom
Al Farooq Al Salti
Austin Asmus
Nathan Asselin
Tristan Attebery
Joey Ballentine
Micheal Baumfalk
Joshua Behlen
Cole Beiermann
Christian Berck
Sanat Bhandari
TyReesh Boedhram
Syrus Bomberger
Ethan Borden
Bryan Borer
Grant Bosley
Tommy Boswell
Robin Bouma
Remington Brandenburger
Jared Breitkreutz
Andrew Buckwalter
Christopher Burbach
Ethan Butt
Joe Carter
Wyatt Chandler
Neil Chen
Zhi Xian Chew
Alex Chmelka
Raksharth Choudhary
Sarah Clark
Braydon Clyde
Collin Cornman
Colin Cummings
Jacob Cummings
Max Danley
Vy Doan
Nathaniel Doher
Zane Dush
Blake Dvarishkis
Joel Eckloff
Jacob Ediger
Aaron Elofson
Emily Ewalt
Youssef Sherif Fathy Sadek Salem
Dennis Feng
Jonathan Forbes
James Fox
Zoe Fu
Dane Gallentine
Ben Galusha
Nasimul Gani
David Garza
Adam Gray
Rustin Haase
Kyle Hadwiger
Conner Hallett
Jacob Hansen
Maggie Harder
Devin Hastings
Yinchao He
Logan Hellbusch
Kameron Heyen
Dominic Hezel
Hallie Hohbein
Mark Hollis
Beau Hottovy
Hengyi Hu
Brandon Huettner
Zachary Hytrek
Easton Joachimsen
Kushagra Kapil
Samir Kashyap
Changsu Kim
Zeyuan Kong
Zihan Kou
Nick Kozisek
Brooke Lampe
Nicholas Lawrence
Eric Le
Ryan Le
Joyal Li
Qikang Li
Nathan Lickei
Dominic Mai
Vu Mai
Richard Maina
Kailei Mao
Joshua Martin
Eric Matz
Anthony McIntosh
Alexander Michael
Brett Middle
Miracle Modey
Jake Modica
Fatima Mohammed
Benjamin Morris
Camryn Moy
James Murray
Vimal Nagalla
Sam Neupane
Kevin Nguyen
Phillip Nguyen
Alexander Nigh
Avinash Nooka
Joey Novotny
Jacob Orellana
Mac Ozanne
Rinish Reddy Pannala
Chase Pearson
Huixin Peng
Ethan Penn
Jacob Petersen
Duc Phan
Paul Philip
Adrian Pilkington
Zhaozhong Qi
Stephen Ralph
Micah Rathjen
David Recic
Jesse Reyes-Cortes
Olivia Rine
Brennan Roberson
Jeron Robke
Dalton Rooney
Jack Rowen
Ibraim Salinas
Alexis Saltzman
Aniruddh Saxena
Alec Schafers
Adam Schlichtmann
Ryan Schmid
Xingjian Shen
Tanima Shrivastava
Matthew Sichterman
Parker Siemek
Demetrius Sigowa
David Snavely
Ryan Soto
Reid Stagemeyer
Kyle Stolle
Joseph Storf
Spencer Stream
Zhenghui Su
Jared Svoboda
Peyton Tanzillo
Zoe Trautman
Logan Uhlir
Garrett Ulmer
Tianrui Wang
Zeyu Wang
Jessica Wheeler
Brock Williams
Michael Wilson
Ryan Witkowski
Yifeng Yu
Anna Zhang
Anqi Zhao
Shichen Zhao
YongShun Zhou
Tyler Zinsmaster
Gage Zittler
Geigh Zollicoffer
Hanlin Zhao

# SENIOR DESIGN COACHES

| NAME | PROJECT |
|---|---|
| **Mark Antonson** | Nebraska Book Company |
| **Brian Ardinger** | Painless Prep |
| **Branden Barber** | Nebraska Department of Labor |
| **Heitor Castro** | Paredox |
| **Justin Collier** | USDA |
| **Paul Cooper** | Madonna Rehabilitation Hospital |
| **Lou Anne Daughtery** | Hoffman Strategy Group |
| **Ron Gallagher** | NU ITS |
| **Myron Garcia** | Regular Phil Brands |
| **Kate Gibson** | Hydroclimate |
| **Jeffrey Haas** | DMSi |
| **Lamin Jawlah** | Holland Computing Center |
| **Shane Kimbrough** | Nebraska Family Dentistry |
| **Steve Kolbe** | UNMC Monroe Meyers Institute |
| **Mark Montz** | Eye Tracking |
| **Tarryn Moss** | College of Public Health |
| **Santi Murtagh** | Buckle |
| **CJ O'Hara** | Agronomy and Horticulture |
| **Steve Trout** | Mystic Rhoads |
| **Drew Ulmer** | The Bay |
| **Steve Voznyuk** | GC Image |
| **Sherry Weber** | Center on Children, Families and the Law |
| **Brad White** | Wireless Testbed |
| **Robin Whitehead** | VR for Structures |

# SPECIAL THANKS TO

Tom Albin
Ryan Anderson
Mark Antonson
Renee Batman
Lauren Becwar
Lori Bennett Baumli
George Blessing
Bill and Marilyn Cintani
Paul Cooper
Steve Cooper
Charles Daniels
Vy Doan
Megan Elliott
Victoria Grdina
Colton Harper
Deb Heckens
Aaron Henry
Nick Hershberger
Dave Homan
Julie Hopp
Dana Hoppe
Jenna Huttenmaier
Carrie Jackson
Mike Kamm
Mitch Kaup
Steve Kolbe
Ann Koopman
Ron Kruml
LaRita Lang
Megan McMasters
William Nunez
Rhonda Page
Ryan Patrick
Michelle Paulk
Suzette Person
Kim Phelps
Max Pierobon
Audrey Polt
Noel Rippe-Cermak
Stephanie Severin
Anton Skretta
Witty Srisa-an
Meredith Steck
Julia Strilkivsky
Corrie Svehia
Shea Svoboda
Matt Wageneim
Mallory Wallace
Marilyn Wolf



## SENIOR DESIGN FACULTY & STAFF

**Tom Albin**
Business Operations Coordinator

**Chris Bohn, Ph.D.**
Assistant Professor of Practice *

**Shruti Bolman, Ph.D.**
Assistant Professor of Practice *

**Bill Browning**
Senior Design Project Manager

**Kyle Conway**
Senior Design Development Manager

**Jeff Falkinburg**
Lecturer *

**Brady Garvin, Ph.D.**
Assistant Professor of Practice *

**Melanie Kugler-Wright**
Senior Design Project Manager

**LaRita Lang**
Events Coordinator

**Jeremy Suing**
Lecturer and Senior Design Project Manager

**Christy Thomas**
Senior Design Director

**Matthew Wagenheim**
Administrative Technician

* Denotes a Senior Design Tribe Lead.

For questions or comments:
402-472-2401 | *cse-seniordesign@unl.edu*

For more information, visit:
**cse.unl.edu/senior-design**

The Department of Computer Science and Engineering
Senior Design
256 Avery Hall
Lincoln, NE 68588-0115
402-472-2401 | **cse.unl.edu/senior-design**
f | @CSEatUNL

To make a gift in support of the Department of Computer Science and Engineering Senior Design Capstone Program
or for more information, please contact:

**Justin Carlson**
**Director of Development for the College of Engineering**
402-458-1196
*justin.carlson@nufoundation.org*

Your gift represents a significant investment in future scientists and engineers, for Nebraska and the nation.

University of Nebraska FOUNDATION

cse.unl.edu