



SENIOR DESIGN 2020-2021

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 53-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 and 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.

MESSAGE FROM THE DIRECTOR



Dear friends,

Welcome to the Department of Computer Science and Engineering's Senior Design Year in Review Report for the 2020-2021 academic year.

Thank you for taking the time to learn about the projects that our students tackled as part of this year's portfolio. This has been a highly unusual year, and the Senior Design staff, faculty, students, and sponsors all adapted and innovated to move forward throughout the development lifecycle and to finish strong. In the pages that follow, you will find summaries of their collective efforts to satisfy the project-based capstone requirements, thereby preparing the next generation of computer scientists, computer engineers, and software engineers.

We are remarkably proud of each of our students who have completed Senior Design. Their talent and efforts continue to amaze us.

While it has been our privilege to guide Senior Design students through their capstone experience, we would be remiss if we did not acknowledge the efforts that other faculty and staff have put into

educating and enabling our department's students to make their success in Senior Design possible. We also thank our students' family and friends who supported them during their college years.

I also offer my personal thanks to the Senior Design staff and faculty for their dedication this year. Your commitment to student success was glaring, and you have set your students up for their future successes.

There are many others both within the University of Nebraska system and in the industry who generously made time for our students directly or through behind-the-scene efforts. Please review the *Special Thanks* section at the end of this report to see others who contributed to the community effort to help our students succeed.

With Gratitude,

A handwritten signature in black ink, appearing to read 'Chris Bohn', followed by a long horizontal line.

Chris Bohn
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:

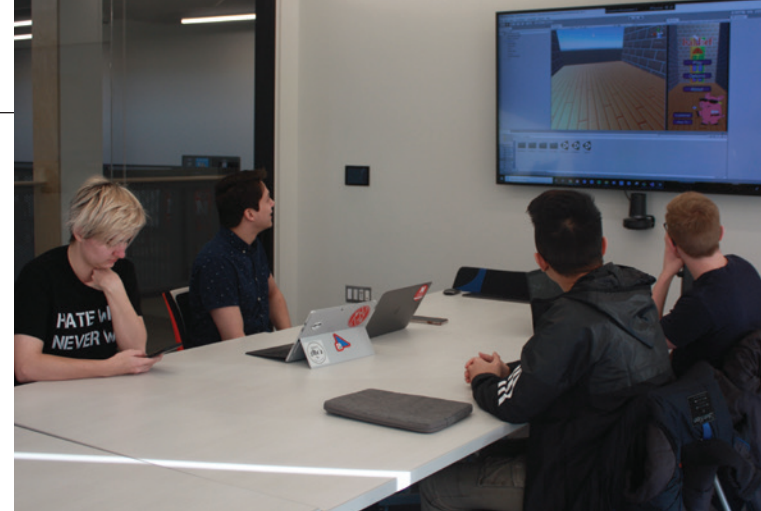
cse.unl.edu/senior-design



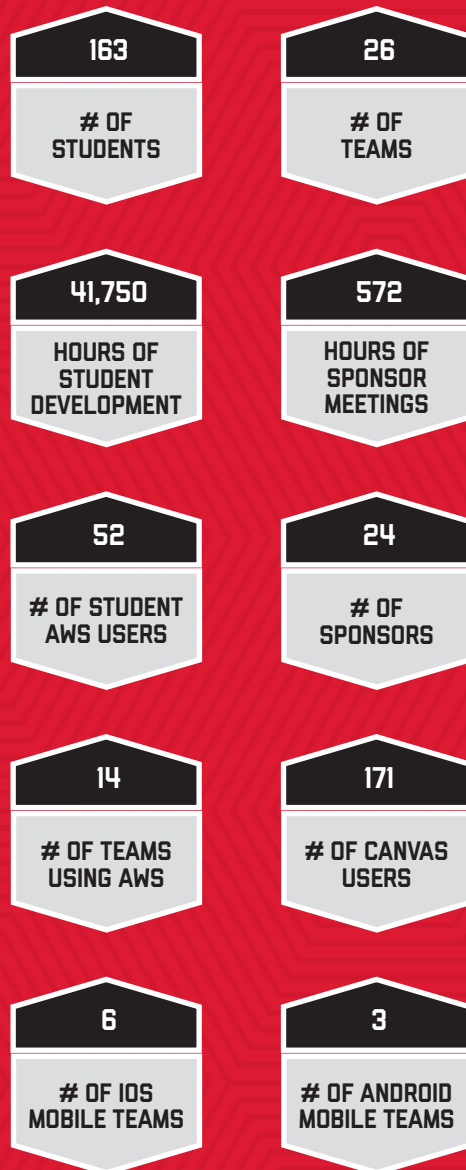
MARILYN C. WOLF

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 other students who encompass a range of backgrounds, skills, and experience. Our Senior Design staff and faculty are passionate about guiding students through challenges—both big and small—to arrive at a successful conclusion.



SENIOR DESIGN STATISTICS



TECHNOLOGIES USED



PROJECT DOMAINS





Sponsor: **Arc of Nebraska**

Project: **Arc Advocates Mobile App**

The Arc of Nebraska is a local nonprofit dedicated to providing advocacy for people with intellectual and developmental disabilities and their families. This involves both directly assisting community members, and representing the disabled community with testimony before the state, county, and local legislative branches of Nebraska. To further both of these goals, the team was tasked with creating a mobile app for coordinating interactions between Arc staff, Arc volunteers, and Nebraska community members.

The team has created a mobile app which allows community members to access general resources concerning any issue they may be facing, and request direct assistance if needed. When direct assistance is requested, the Arc staff may then assign a staff member or volunteer to provide assistance. Such assistance may include messaging the community member, tailoring their list of resources to target their specific needs, and scheduling events on a calendar. This functionality may also be used for communication and scheduling between staff and volunteers. All of this may be accomplished from within the mobile app, and recorded in a database.

Streamlining all of these interactions into one centralized app makes the holistic process of assisting community members much more coordinated. The database records provide Arc

staff with analytics, which not only enable them to provide oversight, but may help them build legislative testimony.

The team overcame many challenges while developing this mobile app. For example, they were originally tasked to integrate the app with the Arc of Nebraska's existing NationBuilder database. The team discovered that to access the NationBuilder API, one must be professionally certified by Nationbuilder, and correspondence with Nationbuilder revealed this to be unrealistic. After brainstorming alternative solutions and working with the sponsors, they quickly devised their current Firebase database, which allowed them to easily integrate the React Native App with a backend.

THE TEAM

Cameron Ramsey

Christian Berck

Devan Steiner

Louis Shakya

Swazy Dalrymple

William Prewitt

Squad Lead and

Project Manager

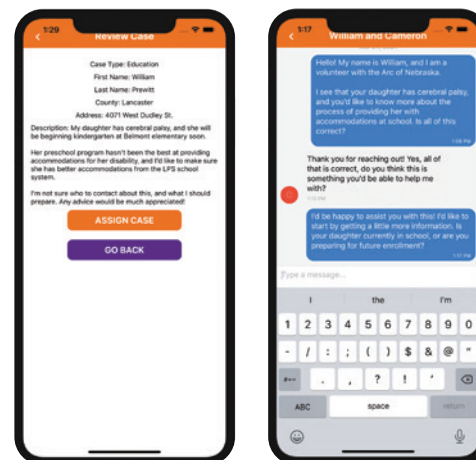
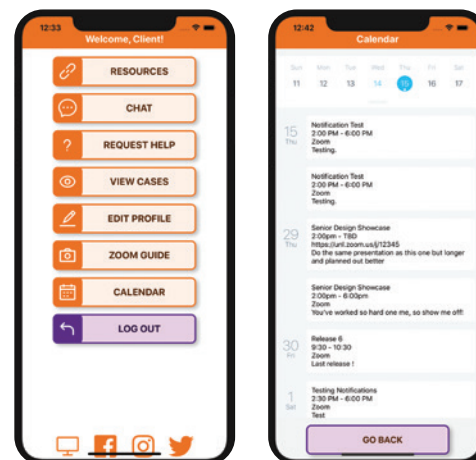
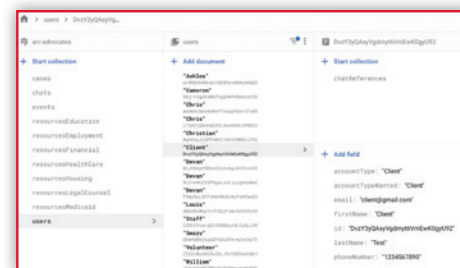
Development Manager

Case Handling Manager

Bugs and Testing Manager

UI/Accessibility Manager

Message System Manager





The team was tasked by the City of Lincoln and Lancaster County with creating a Web form to replace their existing system of paper forms and manual data entry for work-related injury or illness claims. The sponsors envisioned the creation of a Web form that can be easily filled out by employees, via desktop or mobile platforms, and then is automatically exported in the format used in their database system. The team's challenge was to produce an easily accessible Web form that had a uniform appearance, but with some small differences in fields based on the employee's department.

A critical aspect of the project was to keep the data for City of Lincoln employees and Lancaster County employees separate. Specifically, different fields were displayed to employees depending on the organization they worked for, and backend logic was utilized to validate and submit these fields correctly for both City of Lincoln and Lancaster County employees. The technologies chosen for the project were based on the existing software platform used by the City of Lincoln and Lancaster County—Visual Basic .NET. To ensure that the new application would run in the existing platform, the team built the Web form using the ASP.NET MVC Web development framework. The form needed to be cross-platform friendly, so that employees could easily submit a report from desktop and mobile. The team used the React JavaScript framework to

Sponsor: **City of Lincoln/Lancaster County**

Project: **Job Injury and Illness Report**

create a consistent appearance for the Web form on all devices and platforms.

Through much planning, design, and discussion with the sponsors, the team created a Web form from scratch that united both entities' forms into one uniform application. The team ensured that the Web form was accessible, readable, and cross-platform friendly through numerous manual tests and user testing feedback. Finally, accurate and complete data was formatted and securely transmitted into the sponsors' existing database when each form was submitted. The team iteratively received feedback from the project sponsors as well as the Lancaster County risk teams regarding the usability, simplicity, and design elements of the Web form. The result was a Web form that has fields and instructions that are easily understood by employees, offers intuitive navigation using both buttons and a sidebar, and ensures that entered data is stored and submitted correctly and securely.

THE TEAM

Joseph Carter

Tristan Sladek

Trang Le

Joyal Li

Colin Maly

Stephen Rinn

Squad Lead and

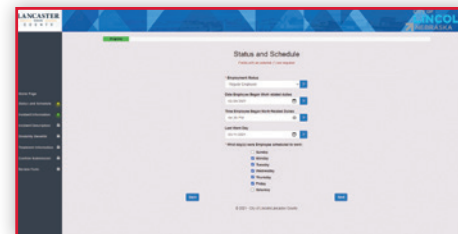
Product Manager

Developer

Developer

Developer

Developer





Sponsor: **UNMC College of Nursing**
Project: **Agriculture Safety & Health VR**

The National Agricultural Tractor Safety Initiative reports that tractors cause about 130 deaths annually, which is 50% of all farmer deaths. Specifically, tractor rollovers make up 44% of farm accidents. The agricultural industry is one of the most injury-prone industries in the United States. Workers are at risk of a multitude of injuries. And with farming being one of the few industries where family members often help out around the farm, ensuring tractor safety is important to injury prevention (Kanoski Bresney).

Currently, there exists a gap in education about agricultural safety with many universities not including it in their curriculum at all. Currently, the University of Nebraska Medical Center's College of Nursing (UNMC) includes agricultural safety in their curriculum, but in lecture format. UNMC has the unique position of being located within an agriculture-heavy state, meaning that tractor accidents are common. It is UNMC's goal to improve the current education using virtual reality to provide a more hands-on experience. They also want the student nurses to be conduits of change and educate farmers and future farmers by utilizing virtual reality at schools and agricultural gatherings.

The team was tasked with creating a virtual reality game simulating a tractor rollover for nurses to better educate agricultural workers and enhance the agricultural safety curriculum. The game was developed for Oculus Quests

using Unity. The object of the game is to place the player in an open-world concept farm where they can explore, learn about items on the farm, and drive a tractor. The tractor is realistic in the sense that it has the same controls as a tractor, the speed of a tractor, and will roll over when the player drives irresponsibly. The game keeps track of what the player did while driving; so that when they crash, it tells them what they did wrong.

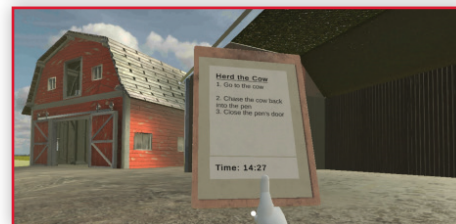
The game has various different objectives for the user to complete, all while trying not to flip over on difficult terrain. They can also free-roam and drive around the farm, collecting gold tractor coins or racing cows. The Agriculture Safety & Health game will be used in UNMC's curriculum, but also will be taken around the Midwest to conferences to educate agricultural workers and school children. The game uses an open-world concept to encourage exploration and curiosity, while also providing a realistic farm experience. It helps players learn about how to drive a tractor safely with no actual real-life risks.

THE TEAM

Adrian Pilkington

Jaden Goter
Jeremiah Cantu
Jacob Fox
Ryan Thomas

Squad Lead and
Product Manager
Development Manager
Developer
Developer
Developer





Sponsor: **UNMC College of Nursing**

Project: **Sepsis Escape Room VR**

According to the Center for Disease Control, “each year, at least 1.7 million adults in America develop sepsis,” and “nearly 270,000 Americans die as a result.” Sepsis is a critical healthcare issue, and better education could potentially save millions of lives and dollars. As stated by the Sepsis Alliance and the Society of Critical Care Medicine, with early recognition, rapid diagnosis, and treatment, 80% of sepsis deaths could be prevented.

Currently, sepsis patients are not being diagnosed early enough and, thus, University of Nebraska Medical Center’s College of Nursing (UNMC) aims to better educate nurses on how to detect and treat sepsis in a timely manner. Nurses at UNMC and across America are being taught about sepsis via lecture format, but this current format is failing the hundreds of thousands dying from sepsis each year. They wish to put nurses in a more realistic situation, where they have to deal with sepsis hands-on virtually, before they ever have to deal with it in real life.

The Sepsis Escape Room VR team was tasked with creating a virtual reality game simulating an escape room for nurses to test their knowledge of sepsis. The game was developed for the Oculus Quest using Unity, Blender, Photon, and free-to-use models. The team developed their knowledge about sepsis treatment and how to best gamify educational material in an effective and entertaining manner. As sepsis is a time-

sensitive disease, the game itself is limited to 20 minutes, otherwise, the patient dies. The idea was to place the player in a room where they must first identify that the disease they are dealing with is sepsis, and then must solve five puzzles relating to the five steps of the Sepsis Bundle in order. Each of the pictures shown represents a puzzle in the game, and five of the rooms correspond to the steps of the sepsis bundle treatment specifically. Each room has a different theme, symbolizing how sepsis can affect people from all different walks of life.

The result of the team’s hard work throughout the semester yielded a finished VR game that UNMC can incorporate into their curriculum for nurses. It has multiplayer functionality so nurses can work together, just like in a real hospital emergency. Every two minutes someone dies of sepsis, but helping raise awareness and improving how we educate about sepsis could be the difference between life and death.

THE TEAM

Adrian Pilkington

**Squad Lead and
Product Manager**

Joey Novotny

Development Manager

William Gardner

Developer

Charles Kaup

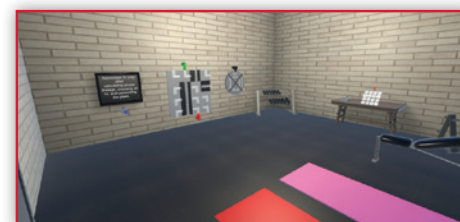
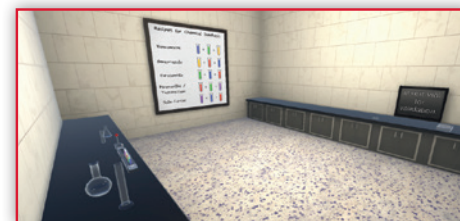
Developer

Sailesh Pujara

Developer

Tanner Skelton

Developer





Sponsor: **CompanyCam**

Project: **Intelligent Photo Management**

The team split early-on to tackle multiple issues within the timeframe of the project. The first co-team focused on development of Intelligent Photo Management and worked mainly within Amazon Web Services, or AWS. The initial goal of this portion of the project was to harness Machine Learning and Image Processing to perform Image Recognition or Image Clustering. Throughout the year Proof of Concept (PoC) models were developed and presented to the CompanyCam sponsors.

The AWS co-team's final product is an Image Anomaly Detection API hosted within AWS. This API is capable of processing incoming images to detect a set of known anomalies possibly present within the images. This API is built on a serverless compute platform called AWS Lambda, which allows code to be deployed with scalability in mind. An AWS API Gateway forwards GET requests to the Lambda function which processes the image and determines its anomaly status based on blurriness file corruption, impossible image dimensions, and pixel variance.

The second team focused on developing a React Native component for Company Cam that would be able to seamlessly integrate into their existing mobile application. The initial goal for this React Native project was to create a custom voice-recognition component that would allow users to interact with the app with more ease.

The final product for the Company Cam voice-recognition component is a library that allows for seamless integration with voice-to-text, listening options, and gesture support. The voice-to-text feature allows for a universal voice-to-text option, regardless of which mobile platform a user is accessing the application through. Listening options allow the team at CompanyCam to trigger events in the app based on different statuses that the component may send back. Lastly, the component features gesture support through shaking. This allows CompanyCam to program actions for users to access different parts of the app while only one hand is available (ex. climbing a ladder). These additions allow for more creative and accessible options for the user.

THE TEAM

Jacob Hansen

Jack Rowen

Linhan Li

Alex Linneman

Michael Martin

Michael Westberg

Noah Costello

Erik Skoog

Ferhan Barento

Tysen Corwin

**Squad Lead and
AWS Team Product Manager**

AWS Team

Development Manager

AWS Developer

AWS Developer

AWS Developer

AWS Developer

React Team

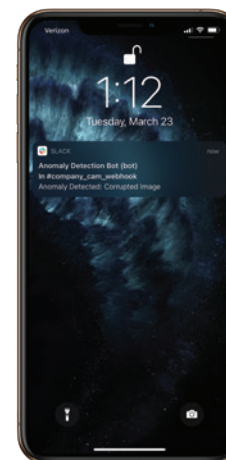
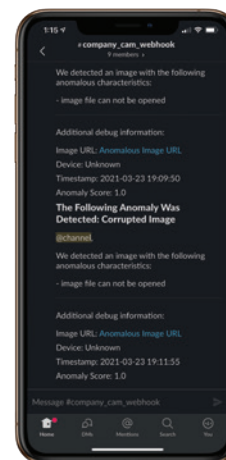
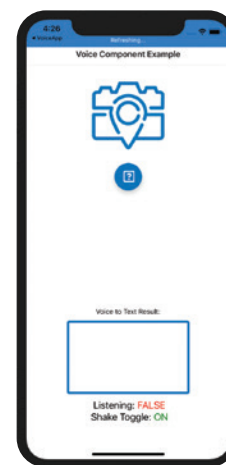
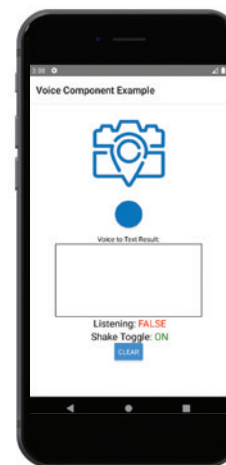
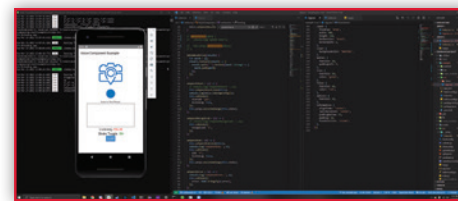
Product Manager

React Team

Development Manager

React Developer

React Developer





Sponsor: **DMSi**

Project: **Modernize Stratification & Optimization Applications**

The goal for this project was to transform DMSi's customer and item stratification as well as pricing optimization processes to a modern Web application. The process today is very manual, and most of the work and logic exist in a series of Excel spreadsheets. Additionally, the integration with Agility, the sponsors ERP, is very light. Both cause a less than desirable user experience and ultimately discourage some customers from engaging in the consulting process resulting in lost revenue for DMSi. A modern touch on these processes help DMSi concentrate their business on their core customers and items maximizing their profit by helping them better understand where they should be sacrificing margin and where they should be increasing it.

The database was created in MySQL by following the Excel sheets and the attributes in each sheet. The three Excel files given by DMSi were Customer Stratification, Item Stratification, and Price Optimization data files. The team exported the data from Excel directly into the database using MySQL for Excel, dealing with any issues that would arise in the process. As each table and all data was imported into the database, the team made the proper connections between tables using keys. Once the database was completed, it was deployed through AWS to have it online and no longer local, as it had been throughout development.

Another challenge was presenting the data from the API. The team created a react front and utilized tables and charts to present the data. They then created three pages, Customer Stratification, Item Stratification and Price Optimization. Each page has information relevant to its Excel counterpart.

We created a json file from data retrieved from the backend and used by the front-end server to render the data in a format easily consumed by the user. The API was divided into several parts namely, Customer and Item Stratification, and Price Optimization. Control Table is a separate component in the whole application. That is where customers can add their own numbers to scale different properties. Control Table is the only component in the API which has CREATE functionality in the whole Web application where the constants can be stored in the database through front-end forms. This was further developed to where new customers can have a new account through the Web application.

THE TEAM

Hassan Abdelsamad

**Squad Lead and
Development Manager**

Soham Patel

Developer

Sergio Carrera

Developer

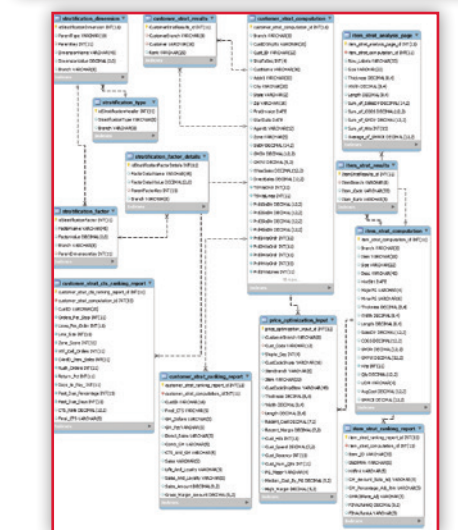
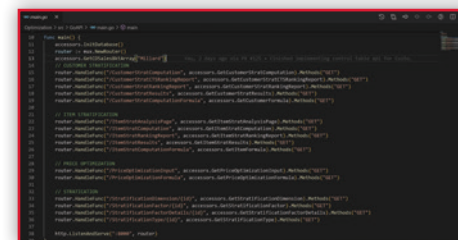
Min Ni Ewe

Developer

Isaac Gillette

Developer

Judith Kwassieu





Sponsor: **Self-Sponsored Student Team**

Project: **SOFTie Startup (Grouve)**

The increased scope of the project meant that the team could not start developing right away. In fact, they did not start development until the second semester of the year. They began with project discovery to ensure their product would be marketable. They then moved into clarifying the priorities of the project. They also had to design the application—this involved creating wireframes, conducting user tests, and ensuring that designs were usable before moving to development.

Both the website and mobile application feature authentication, navigation, and storage of profile and event data. On the mobile side, the team chose to implement a React Native application for Android and iOS. Most of their mobile developers had no prior experience with React Native or even React in general, so it became a learning experience for them as they worked to implement such a large scope. They had to work with multiple integrations—outside services, multiple databases, etc.—that allowed their mobile developers to grow while working within a larger project. On the Web side, the team created a Web application that focused on the event creation and editing processes. It was built using React and Chakra. While building the website, the team gained new skills by working with unfamiliar technologies. Additionally, Web developers got to partake in implementing interfaces from wireframes and altering features based on user research and feedback.

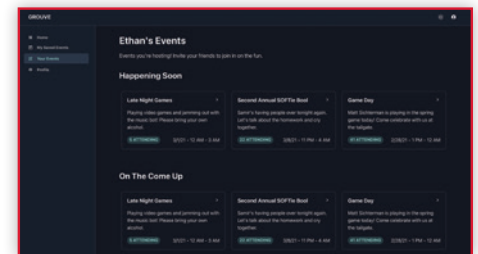
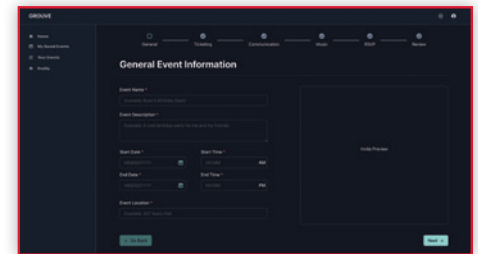
The team also had developers focused more specifically on a shared database for the website and mobile app. The main challenges in this area involved extracting data modeling requirements from wireframes, switching technology stacks when requirements were complicated, and implementing the database in code including authentication. After working to understand the “ins and outs” of AWS Amplify, the team began creating data models and figuring out how to implement them securely. To address authentication issues, the team decided to switch to Google Firebase, which allowed them to more easily secure the backend and implement access control. The final challenge was building the authorization flows within the Web and mobile apps, as well as integrating the database with the frontend.

THE TEAM

Ethan Bütt

Joey Ballentine
Wyatt Chandler
Maggie Harder
Sam Neupane
Peyton Tanzillo
Matt Sichterman
Easton Joachimsen
Ryan Le

Business Team, UI Designer,
Mobile Developer
Mobile Developer
Business Team, Mobile Developer
Business Team, Web Developer
Business Team, Web Developer
UI Designer, DevOps Engineer
Database Architect
Database Architect
Web Developer





Sponsor: **UNL Holland Computing Center**
 Project: **RNA Nanostructures Science Gateway**

Scientists and engineers frequently need to access common data and utilize similar applications that relate to a specific domain. To create this common platform, backed by high-performance compute clusters, science gateways are implemented. For this project, the RNA Nanostructures team constructed a Science Gateway that integrates the RNAMake application with the goal of supporting the RNA Nanostructures scientific community.

The team approached this problem by focusing on two unique elements of the project: extending the Apache Airavata backend system to support job submission to the Open Science Grid (OSG), and developing the front-end component of the Science Gateway. The team extended the Airavata backend by integrating the job submission system to support job submission using HTCondor. The team made this contribution to the Apache Airavata project to enable long-term support and maintenance of the features integrated.

The front-end component of the science gateway was implemented using the Airavata Django Portal. The Airavata Django Portal consists of a landing page, a login system, and an application page with a path to create applications. The team applied user-design and user-testing principles to determine the most usable interface that could be applied toward the portal. Upon completing the design

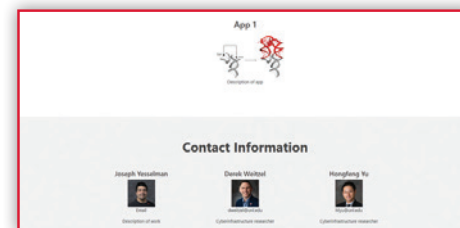
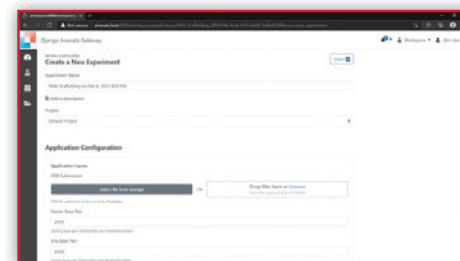
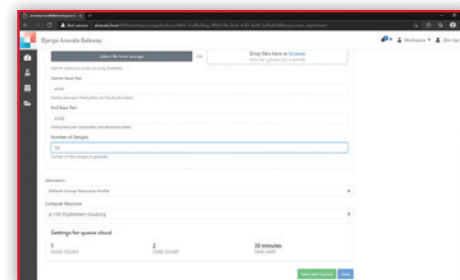
and testing of the user-interface, the team constructed the landing page and the RNAMake application. To further support the requirements specified by the Sponsors, the team also extended the Airavata Django Portal by implementing support for GLMol—an interactive molecule viewer.

THE TEAM

Dan Thibodeau

Daniel Shchur
Al Farooq Al Salti
Conner Elliott
Evan Palmer
Josh Seamans

**Squad Lead and
 Product Manager**
Development Manager
Developer
Developer
Developer





Sponsor: **Lewis & Clark Natural Resources District**

Project: **Certified Irrigated Acre Data Storage**

The Lewis & Clark Natural Resources District needed a Web-based database application to certify the irrigated acres of the district with the landowners and tenants responsible for the acres irrigated. To solve this issue, the team started with the backend data collection. Data collected included shapefiles of parcels and irrigated acres as well as information on wells found from the DNR website. The data was loaded into an SQL database that would later interact with the Web application. The frameworks being used were heavily discussed amongst the team, and a mix of Feathers.js and React.js was decided upon.

When creating the website, the team decided to split it into five main pages. There is a landing page that greets the user and allows for easy navigation throughout the website. From there, the user can navigate to the wells page, which contains a table of wells located in the LCNRD's area of jurisdiction. Upon clicking on the row, a more detailed page will be shown containing the location and details of the well. A similar setup was created for the irrigated parcels page. This page also contains a table containing all irrigated parcels in the area. Upon clicking one of these rows, a parcel edit page will load where the user can edit and view data about a parcel. Alongside this, the user can also generate a formatted letter in PDF format to be printed off and sent to an irrigated acre parcel's owner to certify their irrigated acres.

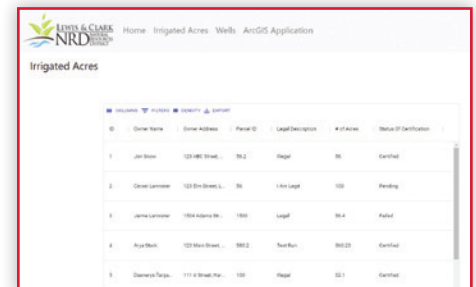
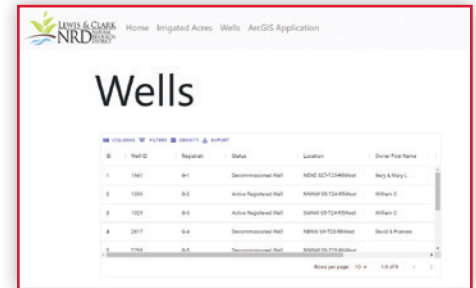
Lastly, the team's Web application required the implementation of a GIS component. When viewing a well or a parcel within the Web application, an interactable map is meant to show up properly displaying the aforementioned piece of data. ArcGIS was the tool most readily available, both from the university and LCNRD, and so it was used for the implementation of the GIS component. A mixture of ArcMap, ArcCatalog, and ArcGIS Online was required to get all the necessary functionality of this GIS component. Specifically, ArcMap was used for originally creating the map, ArcCatalog was required to make the connection between the previously created SQL database and ArcMap in order to show the most recent data on the map, and ArcGIS Online was used to upload the final iteration of the map and allow for embedding it within the Web application.

THE TEAM

Jackson Eickhoff

Sean Termini
Samuel Anderson
Juan Francisco-Simon
Michael Kawamoto

Squad Lead and
Product Manager
Development Manager
Developer
Developer
Developer





Sponsor: **Lincoln Girls Organization for Leadership and Development (Lincoln G.O.L.D.)**

Project: **Website/Scheduling App**

The team was tasked with re-designing the current Lincoln G.O.L.D. website and to create a mobile app that would allow G.O.L.D. girls and members to communicate and schedule events. The website will encourage community members to visit to learn more about the Lincoln G.O.L.D. program and their mission, in the hopes that they would donate to the nonprofit organization. The organization was also looking for a way to interact with members in a more productive and professional way by having their own app. The team delivered a new website that would be appealing to new members and potential G.O.L.D. girls, as well as a mobile app that allows a user to interact with other members and stay up to date on organization happenings.

The team started by creating wireframes of the new website using them as a base to create the redesigned website. The team also added in a member portal that requires a user to create an account before they can see specific content. The goal through completing this website was to make it user-friendly and simple to navigate in order to find specific information about Lincoln G.O.L.D. After the website development was completed, the team moved on to creating the mobile app. The team utilized React Native for cross-platform development and began by creating a prototype of the app screens. The team then moved on to developing the features of the mobile app, including a login and

registration system, a scheduling component to schedule and RSVP to events, a messenger component to message fellow members, an editable 'About Me' page, and a form to submit silent auction items. Throughout the design and development process, the team utilized Expo, an open-source platform for making native apps for Android and iOS, and Firebase, Google's mobile application development platform, for storing app data.

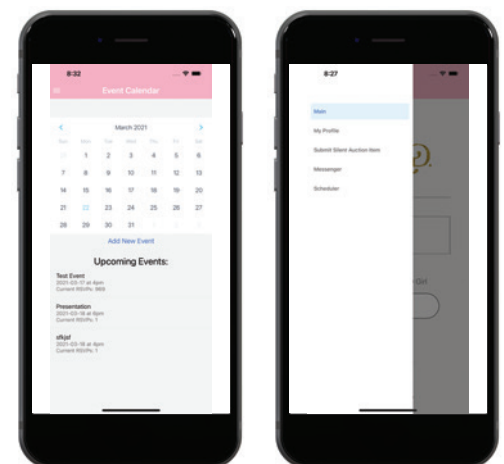
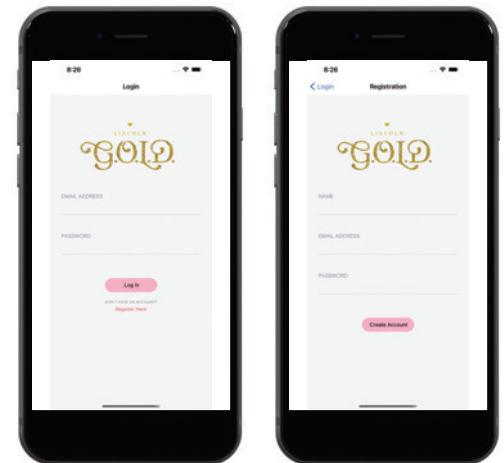
The team's solution provides for a more aesthetic and easier to use website which individuals can use to learn more about Lincoln G.O.L.D. The solution also brings about a means of communication and event scheduling through the development of a mobile application. With the redesign of the website and development of the mobile application, the team desires to allow people to easily read and find information about Lincoln G.O.L.D. as well as bring together Lincoln G.O.L.D. members through a common form of communication.

THE TEAM

Jessica Wheeler

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Inderpreet Kaur
DeLacey Leatherman
Joshua Pokorny
Quinn Reimer

Squad Lead and Product Manager
Development Manager
Developer
Developer
Developer
Developer





Sponsor: **Nebraska Department of Labor**
Project: **Labor Market Machine Learning**

The Nebraska Department of Labor (NDOL) gathers employment data for hundreds of thousands of people every quarter. This data comes from all employers in Nebraska and is not standardized. For recordkeeping and analysis, NDOL needs to label this data with the Standard Occupation Classification (SOC) codes as developed by the U.S. Bureau of Labor Statistics. Labeling by hand is slow and costly. The Nebraska Department of Labor-Labor Market Machine Learning team developed an application that uses machine learning to label this data.

The main requirements were to label data as accurately as a human and faster than a human. The inconsistent data quality made labeling with a database or dictionary impractical. The team decided to use a natural language classifier from Amazon Web Services (AWS) called Comprehend. AWS Comprehend provided a straightforward path for training and integrating the classifier into a final product. The team trained many classifiers with an iterative process and produced a final classifier with 90% accuracy. A single instance of this process is significantly faster than any human. To further improve performance, files larger than 80,000 entries are split and labeled on multiple instances of AWS Comprehend. The result is that a million-line file can be labeled in under half an hour. The classifier also outputs a confidence score so that a human can review

low-confidence answers. This solution greatly increases the labeling speed and consistency while reducing the total workload.

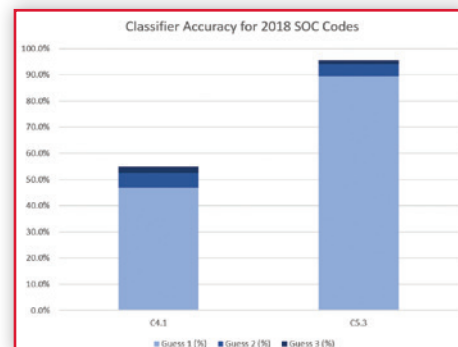
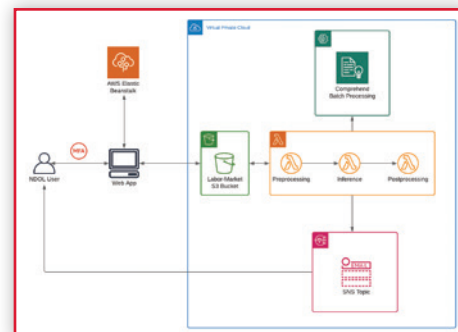
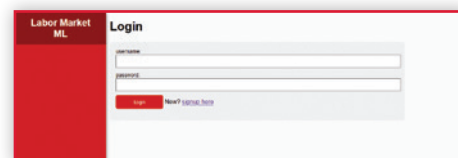
The final product is accessed through a simple front end. A previous team implemented a front end with .NET, but this was outdated. A new front end was rebuilt using Vue.js. The front end allows the user to upload unlabeled files and view labeled files for download. The file is passed through a splitter and cleaner so that the data is properly formatted before it is labeled by the classifier. The labels are combined with the original file and can be downloaded from the front end.

THE TEAM

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Squad Lead and Product Manager
Development Manager
Developer
Developer
Developer





SchedAssist is a mobile application created for scheduling medical appointments with providers. The mobile app, in conjunction with a server developed for administrators to manage patient and staff schedules, allow users to make appointments from their phones without having to call providers, simplifying the scheduling process.

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 consists of three pieces to the puzzle: a mobile scheduling application, a server to handle incoming appointments and location schedules, and a Web portal for administrators to access to manage their location.

The scheduling application was created using the framework from Google called Flutter. This simplifies the development process to where we can create one consistent product with only a single codebase, as opposed to two or three, that will work on iOS, Android, and your browser. An improved benefit the team accomplished was improving the flow of the app for patients when scheduling an appointment for a specified location, provider, or service. All available appointments are first created in the administrator portal, then are sent

Sponsor: **Nebraska Family Dentistry**

Project: **SchedAssist**

through the server in real-time, which lets the user see all the currently available appointments depending on their chosen preferences.

The administration portal had a few issues that Nebraska Family Dentistry and the Development team thought would be good problems to solve to get the admin portal to a state that it can be tested in parallel with their existing solutions. The calendar page had issues with not being intuitive and helpful enough to the user. To solve this, the Development team added filtering by location, provider, service, and a day, week, and month view. Another issue was on the staff page: providers were not able to have and show the different locations they worked at if they took appointments at multiple ones. This required a database change and a change to how the locations for each provider were displayed. The Insurances section of the Setting page also had no functionality. The Development team added a database table and all functionality so that providers can limit and display the insurances that they accept.

THE TEAM

Chris Zagurski

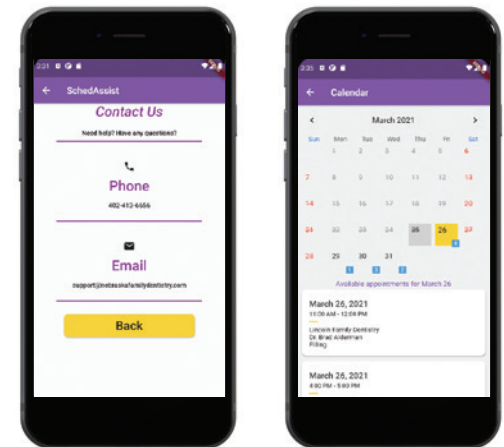
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Name	Location	Job Role
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Dr. Ben Jaskol	Coddington Dental	
Dr. Brad Alderman	Coddington Dental, Northstar Dental	Teeth in One Day Implant Bridge Dentist in West, East, and South
Dr. Brooke Kittell	Lincoln Family Dentistry	
Dr. Josh Day	Coddington Dental	Your Gentle Dental Lincoln, NE
Dr. Kathryn Alderman	Northstar Dental	Dentist in North, East, Central and South Lincoln, NE
Dr. Kimberly Polley	Northstar Dental	Family and Cosmetic Dental Teenager and Children's Dentist in L.
Dr. Michael Burbach	Northstar Dental	Providing Gentle Dental Care in Lincoln, NE

Name	Length	Type	Status
Filling	01hr 00min	Returning Patient	Active
Cleaning	01hr 30min	New Patient	Active
Cleaning	01hr 00min	Returning Patient	Active
Emergency (30 min)	01hr 30min	New Patient	Active
Emergency (30 min)	01hr 30min	Returning Patient	Active
Endo	01hr 30min	Returning Patient	Active
Testing service	01hr 00min	Discontinued	Discontinued





Sponsor: **Nebraska Sports Council**
 Project: **Data Analytics for Fundraising and Program Participation Goals**

Our project goal was to give Nebraska Sports Council beneficial summaries, trends, and graphs on their fundraising and program participation data in a clear, efficient, and visually appealing manner. The team also sought to provide a user-friendly and intuitive user interface, specifically tailored to the sponsor's needs, which would allow for easily performable and repeatable data analysis long after the team was done working with the project.

At the beginning of this project, the team's goal was to find a way to smoothly display the given data in the files intuitively and clearly. The team thought the best way to accomplish this goal was to have the product generate visualizations relating to the given data. Another key part of the teams' initial vision was to create a product with a simple workflow: input desired files to be analyzed, customize analysis, output visualizations that highlight key trends and movement in the sponsors' data over the years. The team set out to accomplish this goal over the course of the school year and never lost sight of the initial vision.

After months of hard work, the team reached a final product, and had accomplished much more than they had initially envisioned. As time passed, the team and sponsor worked together to add additional features to the program, further solidifying its viability and utility for the Nebraska Sports Council. In the

end, the product was more than just plugging in some spreadsheets and throwing some graphs on the screen—it had turned into a fully customizable and manageable state of the art application. Users can choose what kind of analysis they want performed on their selected data sheets and can also choose how they want that data represented by selecting from different visualization options. The program fully encapsulates the experience of completely customizing data analytics. This final product provides astronomically high quality of data representation as compared to the spreadsheets before the project started; the utility this product brings to the sponsor will undoubtedly help in their marketing and outreach initiatives. Thank you to the Nebraska Sports Council for giving this team the opportunity to create a high utility product.

THE TEAM

Cordell Rhoads

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Sam Carrasco

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Zhiyuan Zhang

Squad Lead and

Product Manager

Development Manager

Informatics

Developer

Developer

Developer





Sponsor: **Nelnet**

Project: **Centralized Lender Requirements Program**

Nelnet works with multiple lenders that provide loan programs to clients. Nelnet provides the clients with information regarding different lenders and loan programs available. Currently, all information pertaining to different lender and loan programs that Nelnet offers is found in multiple other areas. Therefore, it has been challenging and time consuming to access various forms of information. The team was asked to create a centralized location for Nelnet employees to view this information.

To overcome this problem, a centralized lender repository was created as a Web app. The Web app collects the information from various locations and presents the information on one page. The Web app includes multiple headers that are associated with different lenders and represented as a knowledge base. Each lender also contains all the loan programs offered by that lender. Several functionalities, such as searching and simplifying the information pertaining to each loan, are presented as well.

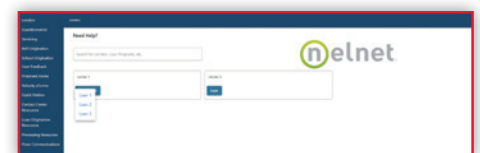
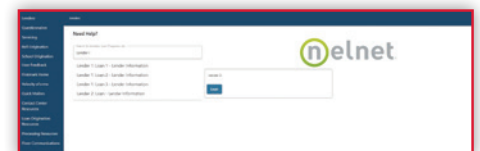
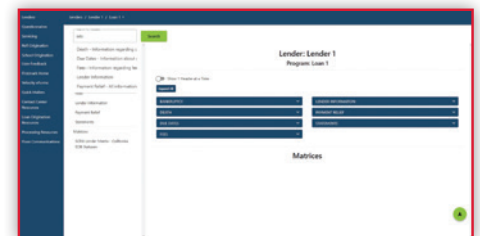
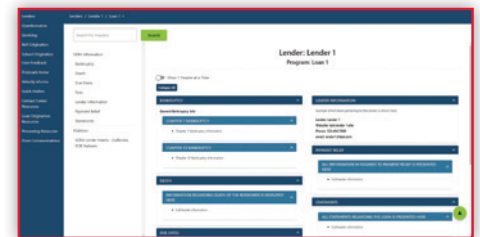
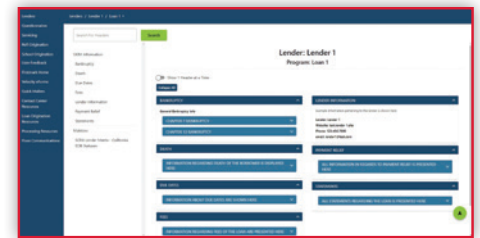
The centralized repository allows call center agents to assist clients more efficiently than before. This results in more efficient access to information, and it is much simpler to maintain. It provides a facile environment for Nelnet employees to look for lenders and loan programs. All in all, it is accessible, secured, usable, and saves time.

THE TEAM

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Jeffrey Park**

**Squad Lead and
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Product Manager
Developer
Developer
Developer
Developer**





Sponsor: **UNL Bureau of Sociological Research**
Project: **Survey Entry Program**

The goal of the Survey Entry Program was to facilitate the design, entry, and verification of paper surveys through an updated user experience. The program was meant to replace an outdated software that the UNL Bureau of Sociological Research currently uses. The researcher's existing system of entering and verifying filled-out paper surveys is tedious and inefficient. The researchers often had to manually edit generated data files alongside maintaining lengthy file paths to each project.

The team developed an executable application compatible with all major desktop operating systems including Windows, Mac, and Linux. The application has a simple user interface, utilizing large fonts and friendly, high contrast colors. Administrators are able to perform user management such as creating new users, removing existing users, and updating users' permissions. In order to maintain the integrity of the researchers' work and data, users can create survey designs that are representative of the ones sent on paper. This allows users to enter the data recorded on the paper survey into the application in an easy and intuitive way. The entered data is then verified by a second user who re-enters the same survey. The application allows for quick navigation through keyboard shortcuts and displays concise visual prompts for any errors encountered or corrections needed. Through a combination of documentation and reverse engineering, the

team implemented the ability to export entered survey data, and all its applicable headers, into IBM SPSS Statistics datasets, allowing the sponsors to take the data directly into the analytical software, without having to deal with complicated data grammars, and without losing meta-data.

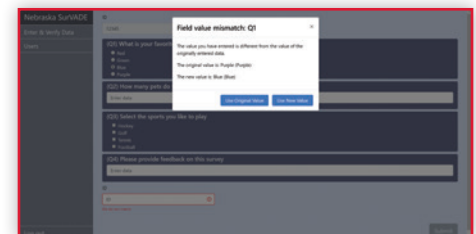
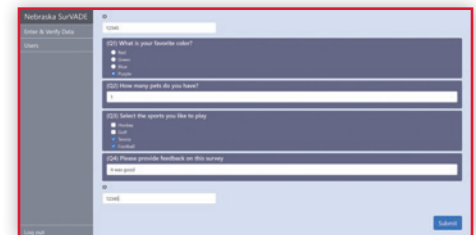
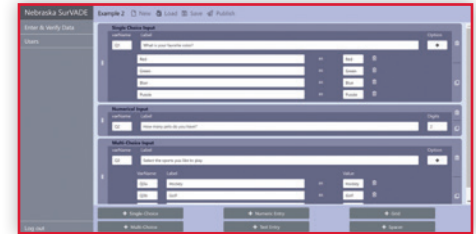
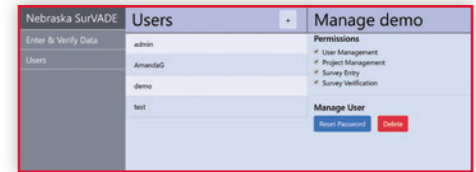
The culmination of the team's work results in a simple, easy to use application that allows for the recording and verification of paper surveys. The solution allows for a more efficient workflow with many quality-of-life improvements for the researchers. The verification process has been streamlined and it is easier to update an incorrect entry if need be.

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Product Manager
Developer
Developer
Developer





Sponsor: **UNL Cave Lab**

Project: **Husker Concussion Rehab**

It is unfortunately common for student athletes to not receive proper rehabilitative care after suffering a concussion. When students do receive that care, it's not unlikely for the athlete to drop their treatment regimen because their treatment isn't tailored to the needs and interests of collegiate and youth athletes.

To solve this problem, the team was tasked with creating an application suite that would aid UNL's CAVE Lab in assigning treatment plans to athletes and ensuring that athletes would complete those treatment plans. The goal of these applications would be to make it easier to assign specific exercises to athletes, track an athlete's symptoms over time, and ensure that athletes were completing their prescribed treatment regimen. To accomplish this, the team worked on three deliverables: A Web-based application for use by CAVE Lab staff to enter athletes into the system, assign them exercises, and monitor their progress through their assigned treatments; and two mobile applications—one for Android and one for iOS—for use by athletes to perform their exercises and rate their symptoms during those exercises.

The team initially designed a user interface and a wireframe until they and the sponsor were satisfied with the proposed design and functionality of both the mobile app and Web app. The team then worked to implement a PostgreSQL database connected to a

NestJS Web service using TypeORM. These communicated with two front-end projects, the Web-based application for clinician use built in React and the mobile application for athlete use in React Native. These technologies were selected to minimize the amount of development necessary to create a release candidate for iOS and Android simultaneously. After work on the database and the GUI were completed, the team focused on developing the NestJS Web service that would allow the two to communicate with the goal of being able to have a clinician register an athlete, assign that athlete a treatment plan, and have the athlete be able to perform the exercises in that treatment plan and rate their symptoms after each exercise.

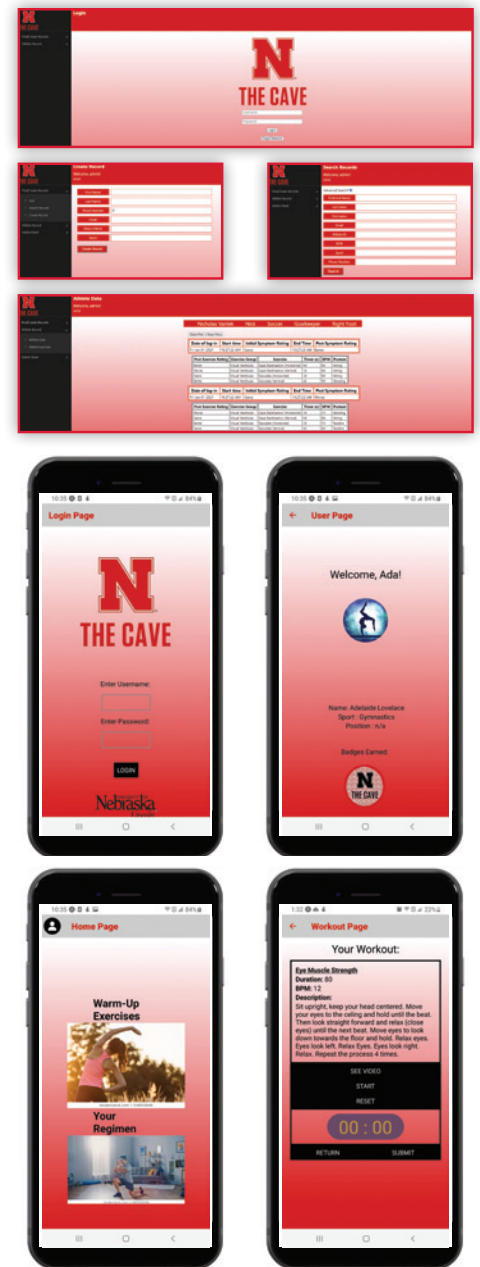
THE TEAM

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Paul O'Dell
Nick Varilek**

**Development Manager
Developer
Developer
Developer
Developer**





Sponsor: **Peyton Weiss and Shruti Bowman**
Project: **Disaster Relief and Coordination App**

The overall motivation for the creation of this application came from Peyton Weiss, a civil engineering major at the University of Nebraska–Lincoln (UNL). Peyton came up with the idea to create an application that would help in the recovery and relief efforts of disasters, such as that of the flooding in Nebraska in 2019. His proposal was that there needed to be a more efficient way to coordinate relief efforts in disasters, such as helping with debris cleanup, food and supply delivery, etc. In serious situations such as these, technology could play a huge role in maximizing efficiency of relief efforts of disasters when it matters the most. Our team decided to develop a progressive Web application that can be accessed from both desktop and mobile environments. This allows for a lot of flexibility in accessing people for help when disasters occur, whether that be from a mobile phone or computer desktop.

The disaster dashboard is the home page of the application where community leaders can post emergency updates to inform their community of important information during natural disasters. Users can follow different locations to receive live updates of those communities. Each post describes the location, the community, and the time for context. Community leaders can make posts, edit, and delete them, so misinformation is minimized, and people receive up-to-date warnings.

One of the challenges we faced in this project was that communities have a greater need for supplies and materials to fix damages during and after a disaster. We worked on implementing a page where community leaders can request specific supplies. Our app directly communicates the supplies that community leaders could provide after major disasters. These supplies included necessary resources to stabilize peoples' lives when they are affected by these events.

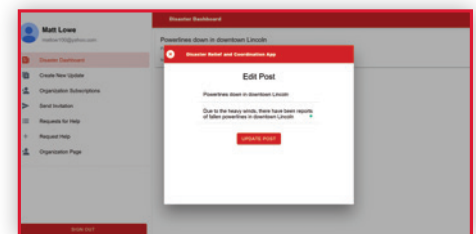
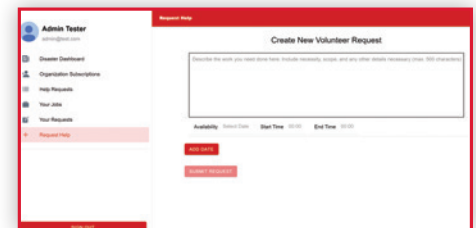
Another big part of our application was the coordination of volunteers. Like the disaster dashboard, our app contains a live feed of volunteer requests submitted by users. For example, if there was a flood, a user could request help for moving furniture. If a user wants to offer their help, they can sign up to be a volunteer within the app and sign up for these requests.

THE TEAM

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Maggie Macfadyen
Logan McCarthy
Wade Schaad

Squad Lead and Product Manager
Development Manager
Process Specialist
Developer
Developer
Developer





Sponsor: **Juan Cui**

Project: **AI-Based Food Image Processing**

The team was tasked with the development of a mobile application that helps users analyze the nutrition of the food they eat, all the way down to the ingredient level. What differentiates this mobile application from others is that users will be able to take pictures of their food to be analyzed using AI. While the sponsors worked on the algorithm for analyzing what ingredients were in an image, the team developed a mobile application that would utilize the algorithm in tandem with nutrition analysis information to make a user-friendly nutrition tracking experience.

To develop the application, the team used several different technologies. One of the first requirements for the application was that it should work on both iOS and Android devices, leading the team to choose React-Native as the mobile-development platform. React-Native allows developers to write React code for mobile applications, where builds can be created on either kind of device. The team developed an application with four pages: a home page, a page where users can input the ingredients, a charts page, and a profile page. On the home page, users can view some basic data about their previous meals. On the input page, users can either manually input ingredients for nutrition analysis, or they can take an image of the food which will go through the sponsor team's algorithm, return the ingredients, and then be analyzed.

After designing the application and the interface, the team worked on integrating a database where user information could be saved and loaded. The team created the database using Amazon RDS. The team accesses data from the RDS database via an API, written with Elastic Beanstalk. It is important that the users' data is kept safe and secure. The team also utilized Google Firebase to handle user authentication and account management.

Using the team's AI-Based Food Image Processing application, users will be able to keep better track of the nutrition of their meals and choose healthier options in the future!

THE TEAM

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Nicholas Fong

Sarah Kornbluh

Alex Rechsteiner

Xinyi Zhu

Squad Lead and

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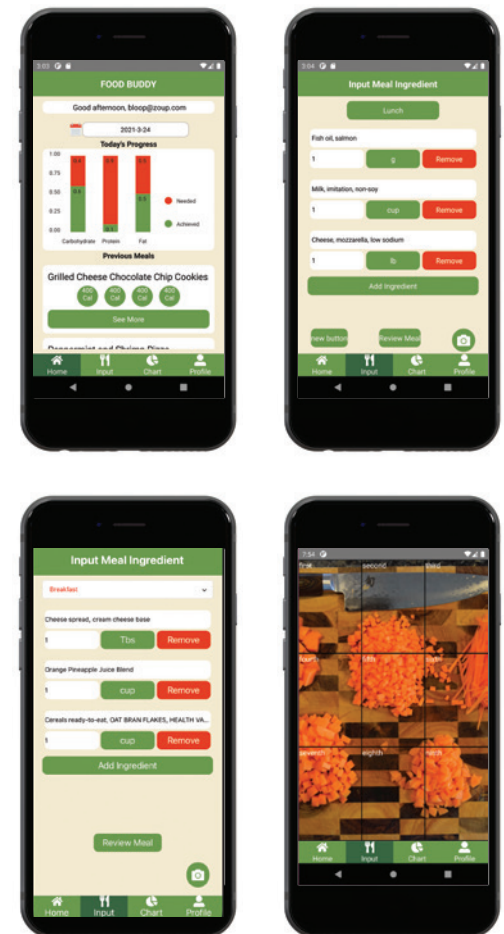
Development Manager

Developer

Developer

Developer

Developer





Sponsor: **Ann Koopman, Ashok Samal**

Project: **Learning Assistant Management System**

The Learning Assistant Program Management Tool (LAProMT) is a Web application designed to be a one-stop location for student and LA needs. The application implements an appointment request system for students, an on-demand appointment management system, hiring management system, and an evaluation system for LA/Admin use.

The team was tasked with creating a forms-based, data-driven system that allows recruitment, retention, and management of learning assistants. The team's solution was to allow management of the hiring process from application to interview to the final decision. The team's solution will also provide assignment of applicants to courses, record-keeping for status and evaluation of work, and collection of evaluations of the LAs from multiple perspectives.

The team was also tasked to design an on-demand appointment system for students to seek assistance from LAs. The team's solution was to develop an intuitive appointment system. LAs will be notified of a request automatically via Slack and students will receive confirmation via email. For the evaluation system, our solution was to embed an existing tool into our application. Students can evaluate their experience with an LA after the appointment. The data from evaluations and appointments will be stored for later analysis and mining.

Lastly, the LA program is designed to evolve to meet student needs and improve the learning experience. LAProMT was designed to be adaptive to the LA program's changing needs. LAProMT can scale up as needed by the LA program allowing new courses and LAs to be added. The team also implemented customizable features, including editable forms for correspondence during the application process.

THE TEAM

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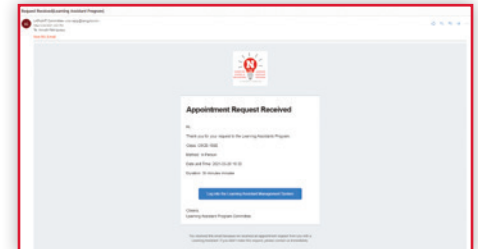
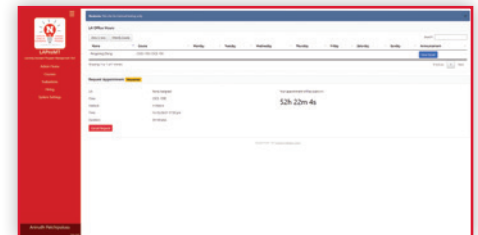
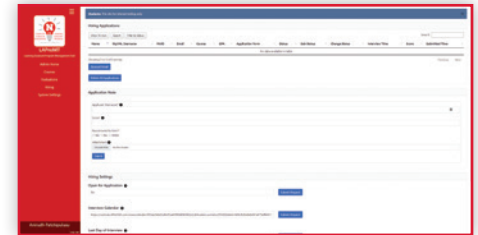
Product Manager

Developer

Developer

Developer

Developer





Sponsor: **Massimiliano Pierobon**

Project: **WetSpace**

The goal of the WetSpace Senior Design project was to pioneer the systematic design and engineering of a completely novel technology based on functional devices, where electronics directly interface with biological processes. WetSpace was built on top of existing software, WetCoDe and PaRedox, which simulate communication processes in wet systems and run bioelectrical simulations, respectively. WetSpace is a Web application which was developed to provide a central hub of communication for existing and future simulation platforms, allowing users to create, run, view, and save simulations across platforms and interact with them in a single space.

WetSpace was designed with a simple, fluid account system which allows users to register and log in safely and securely to use the application. This process was implemented with a variety of technologies, including json Web Tokens and HTTP-only Cookies to ensure secure transmission of user credentials and information, hashing algorithms and technologies to safely store non-plain text passwords in WetSpace's database, and ReCAPTCHA to prevent attacks from bots against WetSpace's login system and API.

The primary functionality of WetSpace is accessed through its dashboard. WetSpace's dashboard allows users to create new

simulation pipelines, which represent the flow of information from a biological “wet” system, through a biological to electrical interface, and vice versa. Each simulation pipeline is composed of multiple simulation platforms, starting with WetSpace and PaRedox. Using a simulation pipeline, a user can enter/upload data, run a simulation on the selected platform, view the results of the simulation, and pass the resulting data “down” the pipeline to the next simulation platform.

In addition to the dashboard and the rest of WetSpace's GUI, the team implemented backend functionalities and libraries to facilitate the growth of the WetSpace ecosystem. WetSpace's backend includes a Database Access Layer, extensible API, libraries for security and intercomponent communication, and more. Combined, these features allow WetSpace to grow as a platform in the future, with extensible functionality and the ability to integrate additional simulation platforms.

THE TEAM

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Sponsor: **Peter Revesz**
Project: **Ancient Inscription Database
and Analytics (AIDA)**

The AIDA (Ancient Inscription Database and Analytics) System is an online database of ancient inscriptions in Linear A, Cretan Hieroglyphs, and Phaistos Disc. Our team was tasked with making the website more user-friendly, correcting parts of the database, and adding statistical analysis for researchers to identify symbol frequency. The first issue was the most important, as in the previous iteration of the website, Linear A symbols did not display correctly on the website and searching had to be done by manually inputting a string of ID values separated by hyphens. In addition to this, searching by languages other than Linear A, such as Cretan or Phaistos, was difficult because users could only search by Linear A, which meant that they would have to manually translate sequences beforehand.

Our team's solution to this problem was to allow users to select which language they would like to search by with buttons on the home page. Following the selection of the language, users are shown a virtual keyboard for their language where they can click which symbol they would like to search by. When the submit button is pressed, we take care of adding hyphens between each symbol to correctly match the database and return a correct search result. In this current website iteration, the user can see all symbols and search much quicker. Adding this feature was one of the most important parts of our design and a core focus of our project.

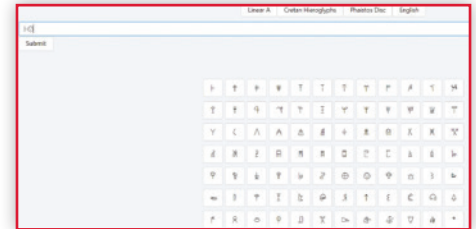
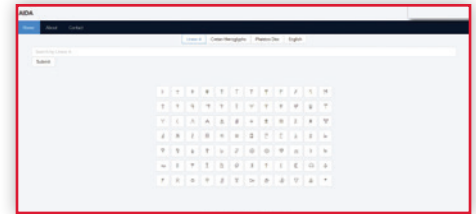
A big feature that was added to the AIDA system was the statistical analysis tool. Researchers would like to know how frequent certain symbols appear in the entire database and what symbols they appear next to. This would help them understand the languages better and possibly help with deciphering more of Linear A. Our team constructed a Statistics tab on the top of the website and when clicked, it will direct the user to a page with matrices that count when each symbol appears by another symbol in the entire database. A major hurdle for our team in this was the time it took to calculate the frequency of each symbol in the entire database. To minimize loading time, we decided to allow users to select which language they would like to see statistics for. This solution means we do not have to load every matrix as soon as the Statistics tab is clicked, and users will not have to wait as long to get their results.

THE TEAM

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Development Manager
Developer
Developer
Developer



Project: **Dynamic Soil Properties**

On the backend side of the application, the API—an application that receives requests for data and sends responses—receives the filter data from the Web application and retrieves the appropriate data to return to the user. Once the data has been retrieved, the API sends it back to the Web application for the user to see.

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Cody Berglund
Elliott Heineman
Xinyue Liu
Mike Schaffer
Demetrius Sigowa

Squad Lead and
Development Manager
Product Manager
Developer
Developer
Developer
Developer
Developer





Sponsor: **Bonita Sharif**

Project: **CoderGaze Eye Tracking**

Creating a Web-based visualization application from the ground up presented many challenges while working on this project. The challenge for this year's team was to build upon the core tracking application that had been built by the previous years team. Having to look through code and conceptualize what each section was meant to do was our first challenge, and spending our first release familiarizing ourselves with the code as well as making small tweaks to the code was very beneficial for our development cycle.

The teams next challenge was the creation of a Web application. One of the major goals for our team this year was to create a visualization of the data that the core application could collect that would be both readable, as well as understandable. The team made the decision to scrap the barebones Web application last years team had created and start fresh. This posed two major challenges for us: first, there was a lot of processing to make the outputted data into a useable form, and second, finding a way to present the data in an informative and useable way.

Data processing was a more straightforward challenge. Dr. Sharif's heavy experience in this field allowed our team to use standard processing tools for eye tracking data, like fixation filters. These allowed us to take our data and combine it into "Fixations." A fixation

would allow our team to determine what a user of CoderGaze looked at and for how long. Being able to combine the data effectively and accurately was mandatory for creating an intuitive and informative graph.

Our more abstract challenge with the Web application was the graph. There were many different styles of graphs that are used for displaying eye tracking data. Communicating without sponsors Dr. Sharif and Cole Peterson, we designed a data display that was able to show where a user looked in a code file, how long they looked at a certain token, what was the flow of what the user looked at, and what was the type/categorization of the token.

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David Gao

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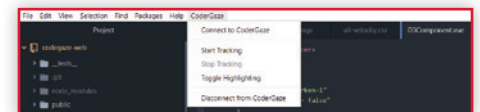
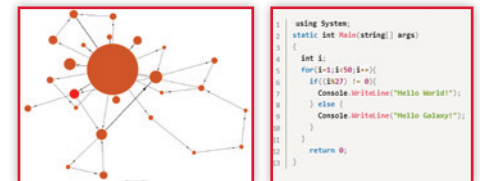
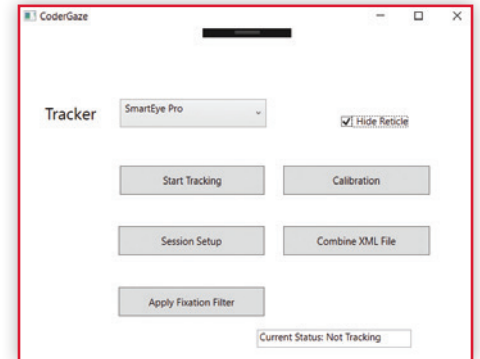
Product Manager

Development Manager

Developer

Developer

Developer





Sponsor: **Leen-Kiat Soh, Ashok Samal**

Project: **SURGE Visualizer**

Given a legacy system with limitations on a variety of usability and performance standards, the team decided that the creation of a new application framework would be intrinsically beneficial in the long-term. The team chose the following technologies to develop the new application: ASP.NET Core, ReactJS with the Hooks API, and Google Maps. Additionally, Microsoft Azure was selected to host a working build of the application for developer and end-user testing. Once framework setup was completed, the team's next challenge was to make a copy of the existing SURGE database so that the data could be accessed during new development without interfering with the legacy application. The breadth of data contained within the SURGE database presented a challenge. Despite the amount of data, the team was able to successfully clone the database and host a duplicate using Amazon Web Services. With the two initial tasks completed, the SURGE team was able to focus on replicating the functionality of the legacy application in the project's new development.

The application improved the standard of usability via interface design as well as functional improvements made to the filter menu simplifying the action of searching for specific instances of social unrest events. The team also aimed to create a more user-friendly version of the tutorial, which walks first-time users through the different functions of the application. On

the map layer, the inclusion of the Google Maps API's infrastructure provided critical insight to the location of key cultural, governmental, and spiritual buildings. SURGE's map layer also allows the user to highlight roadways, railways, and other vectors of transportation.

At the start of the project, SURGE only displayed data for 19 countries. Progress was made to allow SURGE to display events for any country in the world. The team also worked on implementing a user authentication system for the application. This system allows users to create accounts and login to SURGE. A framework has also been developed which will allow authorized users to upload custom data to SURGE. The team has worked tirelessly to ensure that the product created by the end of the senior design development cycle was compliant with modern design standards and the mission of the SURGE project. The team is confident the impact of our work will reach researchers, professors, and other interested parties for years to come.

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Spencer Stream

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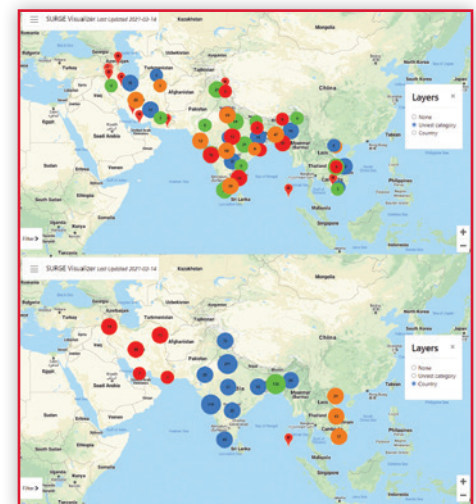
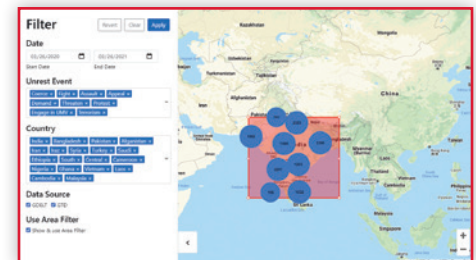
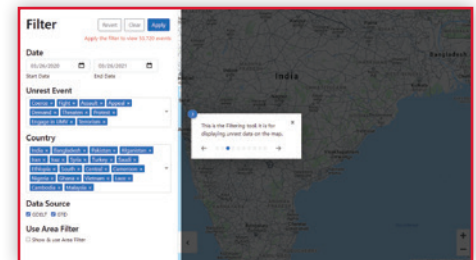
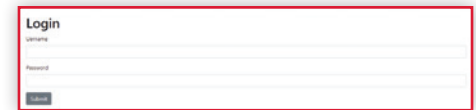
Product Manager

Process Specialist

Developer

Developer

Developer





Each year, the Nebraska Game and Parks Commission funds studies on angler behavior. These studies involve clerks visiting various water bodies around Nebraska to interview anglers and collect information on the conditions and number of anglers present that day. The information collected by the surveyors is used by the Nebraska Game and Parks Commission to provide quality fishing opportunities through science-based management.

The current process was slow, tedious and used outdated technologies. The team was tasked with creating an application that would allow creel surveyors to enter information as it was collected, such as during an interview with an angler. The primary challenge was that many of the areas being surveyed were without Internet or cell reception. This meant that the application could not depend on being able to always connect to the database, which added a layer of difficulty for the team to overcome.

The sponsors' initial thought was for the team to create both a desktop and a mobile application that could add offline functionality to their surveys without having to go back to paper. During the early stages of planning, the team and sponsors decided to instead use a Progressive Web Application (PWA). A PWA can be both run and installed using the Web browser of any device, allowing it to function on a variety of devices and operating systems.

Sponsor: **UNL School of Natural Resources Fish & Wildlife**
Project: **Remote Creel Data Entry and Reconciliation**

In this way, the app works the same way the sponsors wanted it to without adding the extra time and support needed to develop both a computer and mobile version of the application. In addition, a PWA can still be run using the Web browser even without an Internet connection, allowing the app to function when creel surveyors are entering data offline.

When online, the PWA interacts directly with the already established SQL database used for storing creel data. If a user is in a location without an Internet connection, the surveys are cached locally until a connection to the database is established. The PWA also catches common errors within the clerk's entries, such as abnormally large or small fish sizes. This is a large improvement to the interviewing and recording process, as the previous paper survey was solely reliant on the clerk writing down the correct information.

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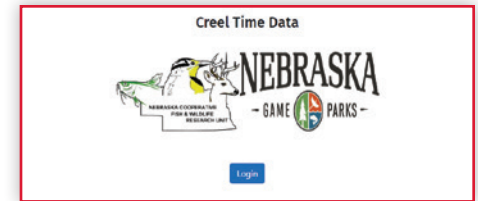
Product Manager

Development Manager

Developer

Developer

Developer



Interview Refused

Angler Party Information

No. of Anglers: Angler Type: Angler Method:

Start Time: Interview Time: Hours Fished: Minutes Fished:

Trip Type: Most Sought: Zip Code:

Interviewed at this Water Body? Fished at this Water Body?

Fish Harvested

Name	# Harvested	Lengths(mm.)
Blue Catfish	4	630, 720, 550, 730
Striped Bass	2	105, 154

Counts

Row	Back	Angler	Time	Period	Section	Time	Rate
1001	4	5	1	1	1	1	1
1002	2	1	1	1	1	1	1

View/Edit Data

Date	Creel	Period	Section	Anglers	Time	Rate
2021-02-10	Survey Park 2010	2	9	1	1015	0.01
2021-02-05	Branch Dam 2010	1	9	1	1015	0.01
2021-02-25	Interim 2010	1	12	445	1044	0.01
2021-02-25	Interim 2010	1	12	445	1747	0.01

GENERAL INFORMATION

COUNT INFORMATION

Creel Survey



Sponsor: **UNL School of Natural Resources**
Water Quality

Project: **StreamNet - Water Quality Data Visualization**

StreamNet presented an interesting challenge of connecting a network of water quality data sensors and serving that data in a public way. The team needed to create an application to aggregate data from sensors across Nebraska and display the data on a Web page. The website needed to offer both visualization tools to summarize the data for easy comprehension, and the ability to download segments of the data to allow independent researchers to perform their own analyses.

The visualizations are produced by the Plotly.js charting library, and provide time-series graphs of a chosen variable over time. A user can select the variables they want to analyze, such as temperature or chemical concentration, and compare up to three charts at once. Each chart can be configured to include data from every sensor available, or any subset of them.

Any user who makes an account with StreamNet can download a csv file containing daily averages of their chosen variables and sensors. If a user wants access to the raw hourly data, they can submit a request through their account page, and upon approval they will be granted access to download the raw data. This allows StreamNet to monitor what kinds of users are interested in the data, and it allows users to perform their own analyses on the raw data directly.

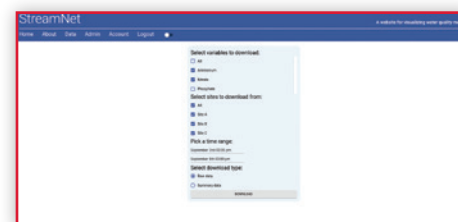
Special thanks go to the Nebraska Environmental Trust for making this project possible.

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Samuel Anderson, "Product, Process, and Professionalism: An Analysis of Industry Practices in Senior Design"

Ethan Bütt, "Entrepreneurship in Capstone Projects: The Experiences of One Self-sponsored Team"

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Justin Carlson

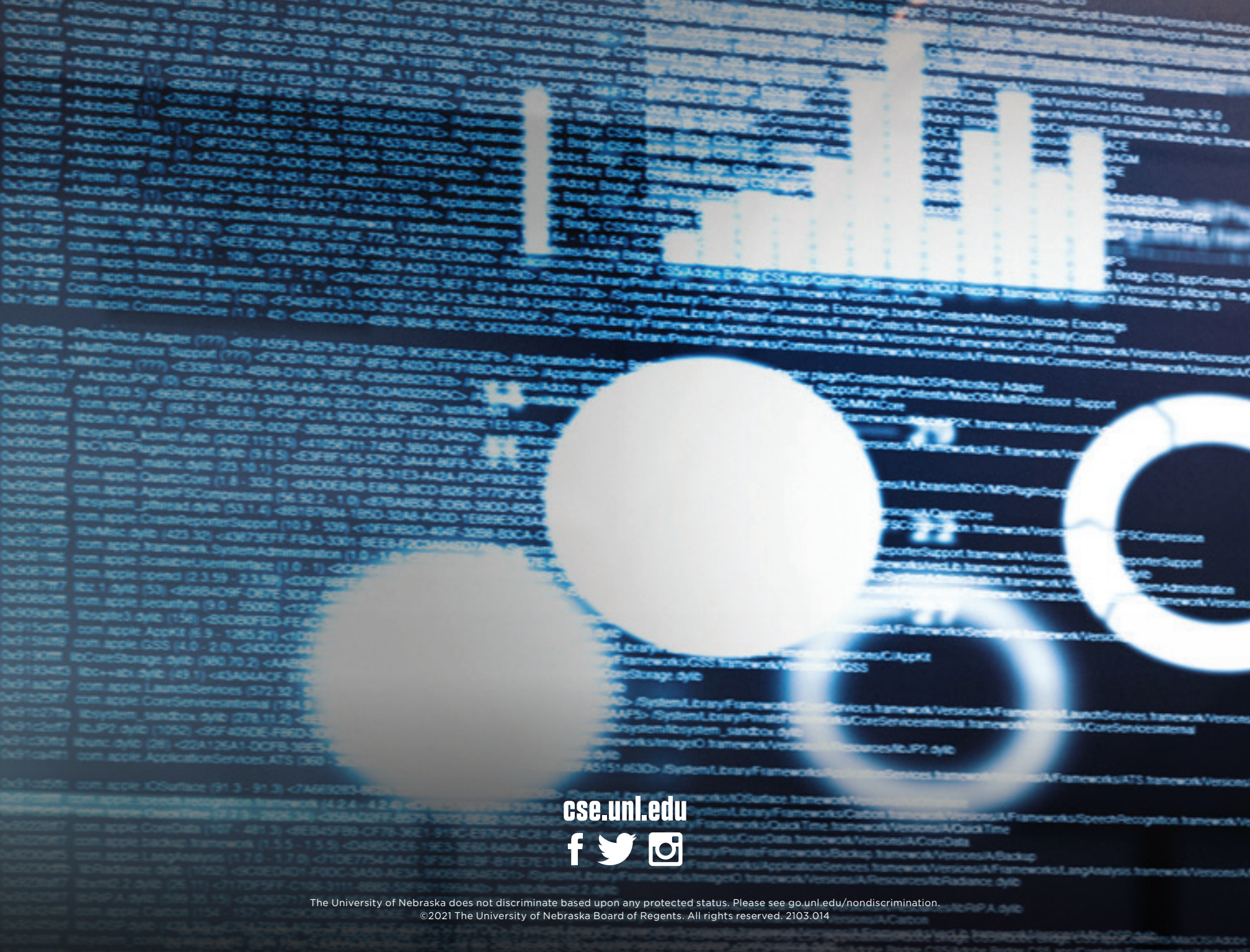
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