2019-2020 Annual Report

DESIGN STUDIO

Jeffrey S. Raikes School of
Computer Science and Management

Contents

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Continuing to lead in interdisciplinary education.

Since the founding of the Jeffrey S. Raikes School of Computer Science and Management in 1999, our mission has been interdisciplinary education, specifically at the intersection of computer science and business management. This curriculum has evolved to include more topics such as data science and leadership. As the capstone for the Raikes School, Design Studio takes interdisciplinary education and applies it to a real world experience. We've also evolved, taking our interdisciplinary focus beyond just computer science and business.

In fall of 2016, UNL accepted the first students in a new major, software engineering. Software engineering at UNL is a rigorous program, including significant math and engineering coursework. The distinction with computer science is important, especially for Design Studio – computer science is a liberal arts major, taking a broad approach to the study of the principles and use of computers that covers both theory and application; software engineering is an applied knowledge major, largely concerned with the application of engineering processes to the creation, maintenance, and design of software. Design Studio has always focused more on software engineering than computer science, and having both disciplines represented by students in our program only enhances our breadth of skills and knowledge.

Another change this year is our new pilot program with the Nebraska Business Honors Academy. Originally started in fall of 2013, the Academy is a four-year, cohort-based, enhanced business curriculum for high-ability students in the College of Business. Since 2005 Design Studio has invited top students from Computer Science & Engineering to participate in what we term our Associates program. This year we admitted our first Academy Associate. She has been a valued member of the Microsoft team and we look forward to more Academy Associates bringing their unique skills and perspectives to our program.

Finally, be sure to check out the Kiewit and Olsson projects this year. Both of these projects include significant components of mechanical engineering. This is no coincidence with the fact that we have two mechanical engineers graduating from the Raikes School this year – we wanted projects for them that incorporated that discipline and demonstrated that Design Studio isn't limited to computer science and business, but can incorporate many other disciplines.

In a world filled with buzzwords, it's easy to claim being interdisciplinary – here in Design Studio we're not just doing it, we're leading the way.

Mark Antonson
Director of Design Studio

Overview

Design Studio uses a design-centered process for innovation to give University of Nebraska-Lincoln students studying at the intersection of business and engineering a highly interdisciplinary capstone experience. By engaging industry partners, we guide students in the development of innovative solutions to complex real-world problems using modern engineering principles, preparing them to excel in their post-graduate careers. Through these strong, collaborative industry partnerships, we are strengthening the community and supporting the transformation of cutting-edge research into innovation. We believe fundamentally that software has the power to transform the world. It is able unlock the potential of both those who use it as well as those who craft tangible products from and with it. The study of software product development forms an ideal mechanism for training students in both creative design and model-driven engineering processes.

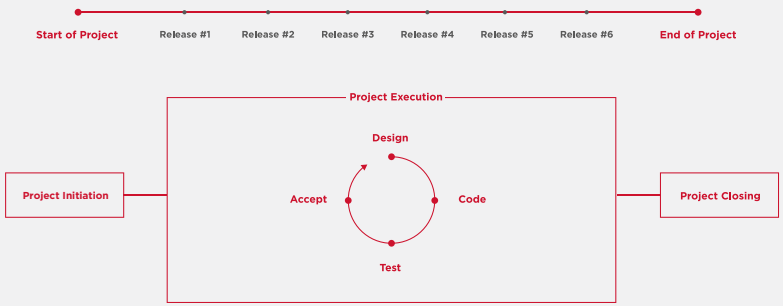
Students in Design Studio participate in a two-semester industry partner sponsored product development project. Using a release-driven approach to development which builds on agile Scrum methodologies, students work in a self-organized team to design, develop, and release work product to sponsors three times during each academic semester. Students learn first-hand how to leverage software to solve complex problems by applying knowledge gained in the classroom to the actual practice of working in teams with customers, managing changing requirements, conceptualizing problems, and designing and building robust solutions using software. Management principles such as interaction with C-suite executives, team development, leadership, and sponsor and risk management are learned hands-on. Students leave Design Studio having gained experience that places them two to three years ahead of peers graduating from college.

Since its beginning in 2001, Design Studio teams have completed well over 200 projects for more than 80 distinct partner organizations including Microsoft, Hudl, Mutual of Omaha, IBM, PayPal, and Fiserv. Some successful projects include video analysis tools for student and professional athletes, way finding solutions in hospitals, new approaches to state food assistance programs, predictive data tools for health care, and mobile technologies supporting e-commerce companies. Whether it is an open-ended problem needing multiple creative solutions, or a well understood space needing a specific system, teams in Design Studio are up to the challenge!

Project inquiry begins in spring with selection and commitments made in May and June. Design Studio faculty and staff are available throughout the inquiry phase to answer questions and assist with the development of a project proposal. We continue working with the selected partnering organizations in July and early August on scoping and project initiation. After the sponsor orientation in mid-August, projects are rolled out to students and teams formed at the beginning of the school semester. Student teams are comprised of around 5 high-achieving college juniors and seniors working 12-15 hours per week during the 29-week academic year, culminating with the final product delivery in May.

> Please visit **http://raikes.unl.edu/design-studio** if you are interested in partnering with Design Studio or learning more.

Design Studio Process



Project Initiation

Objective: Become acquainted with sponsor and project. Leverage design thinking to determine process for execution of project.

Project Execution

Objective: Produce and deliver value for sponsor through cumulative iterations.

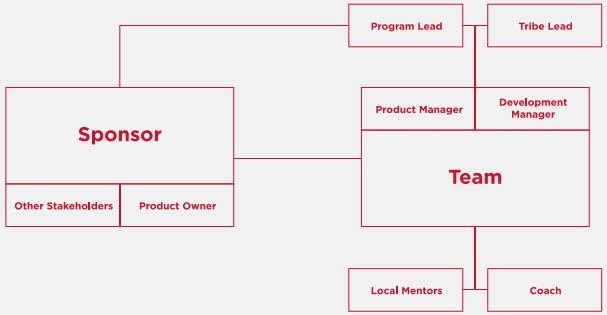
Checkpoints/Releases

Objective: Demonstrate and defend what you have done to this point. Provide direction and plan for completing remaining project.

Project Closing

Objective: Transition value to sponsor. Finalize and assess project and prove success.

Design Studio Roles



Team

Students self-organize into teams. Teams have two specific roles, the Development Manager and Product Manager, who together share the responsibility of leadership for the team.

Product Owner

The representative from the sponsoring organization who is both the day-to-day contact and has decision making authority within the project scope.

Program Lead

A staff member in Design Studio who supports the team and provides professional guidance from the industry perspective.

Tribe Lead

A faculty member in Design Studio who supports the team and evaluates from an educational and learning perspective.

Coach

A volunteer from the local community who serves as a professional and technical mentor for the team – an independent sounding board.

Student Teams follow a highly interactive, iterative development framework. Teams focus on execution of the project, releasing versions of the product they are developing six times during the year. This allows partnering organizations multiple opportunities to use, evaluate, and give feedback on what is being developed. Serves as a framework for all Design Studio projects.

Mark Antonson
Director of Design Studio, Tribe Lead

Director since 2017, returning graduate of the Raikes School and Raikes MBA programs after 10+ years of product management, architecture, and software design experience. Coached Design Studio teams before serving as Director.

Cheryl Nelson
Design Studio Program Lead

Seasoned industry professional who returned to her native Nebraska after directing global teams in software development and engineering for large Fortune 100 companies.

Dr. David Keck
Professor of Practice, Tribe Lead

Developed and teaches the school's core sequence in Data and Models, which includes topics from probability and statistics, data science, machine learning, simulation, and optimization. Also teaches the school's finance course.

Lance Nelson
Interim Lecturer, Tribe Lead

20 years of software development and management experience and, most recently, 8 years an entrepreneur.

Bhuvana Gopal
Assistant Director of Design Studio, Tribe Lead

13+ years of software design, development and implementation experience in various capacities (Senior Software Engineer, Team Lead, Technical Lead, Project Manager) using object-oriented technologies including the .NET full stack and J2EE technologies.

Jeremy Suing
Design Studio Program Lead

20+ years of experience developing and managing software projects in both enterprise and academic settings. Managing projects and operations for Design Studio for 14+ years.

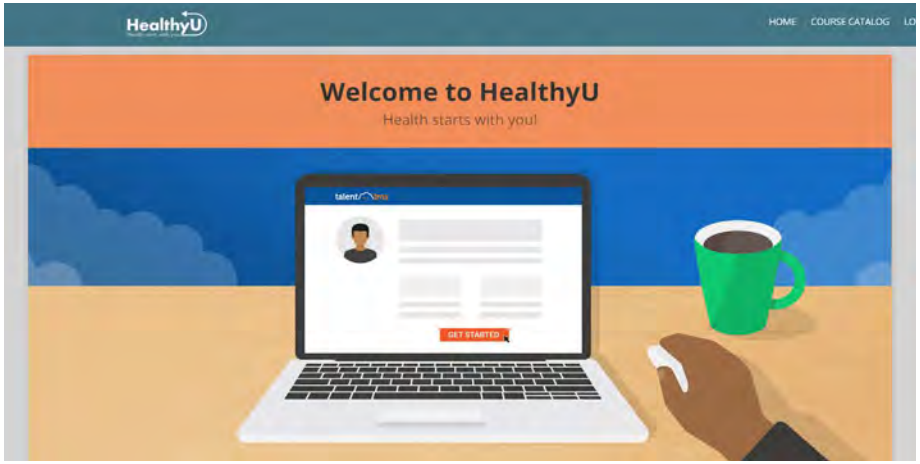
Dr. Stephanie Valentine
Assistant Professor of Practice, Tribe Lead

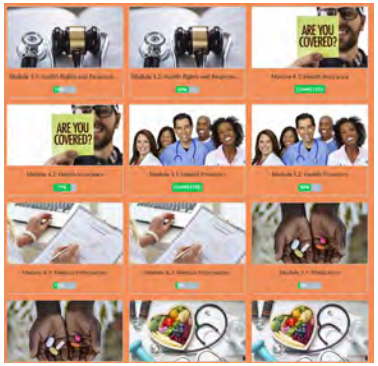
Instructor for most underclassman software engineering courses at the Raikes School. Passionate about working with Design Studio teams working on novel interaction design and applied machine learning.

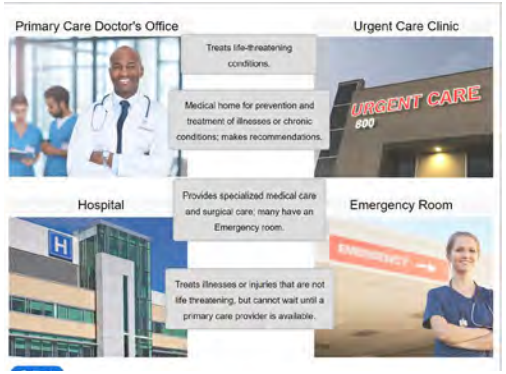
DESIGN STUDIO STAFF

Design Studio is a mix of new and familiar faces this year, not just among the students. The program has a core staff of four full-time employees, with 20+ years of combined Design Studio experience, plus the support of the Raikes School faculty. Of course six people can't possibly support 111 students in a program like Design Studio – it takes a village including our volunteer coaches, so flip to page 30 to see credit where credit is due.

DESIGN STUDIO PROJECTS







ACADEMY FOR CHILD AND FAMILY WELL BEING

HealthyU

The Academy for Child and Family Wellbeing (ACFW) is a partnership between UNL's Department of Special Education and Communication Disorders and Boys Town. Their mission is to enhance the well-being of children with and at-risk of disabilities and their families by developing, implementing, and evaluating services that empower families and youth with emotional and behavioral needs. One of the ACFW's funded projects, HealthyU, is to build a web-based curriculum that teaches adolescents with disabilities the how to's of medical self-care not typically taught in traditional health curricula, including but not limited to accessing and using insurance, medication management, and managing medical emergencies. This curriculum has been through two iterations – a pen-and-paper based curriculum, and curriculum hosted on a WordPress website that suffered from issues of design, accessibility, and performance during its first pilot test. The ACFW needed a more robust web-based solution before integrating HealthyU as a regular part of high school health curriculum.

The HealthyU project team found that based on the needs and the importance of performance and scalability, that sourcing a learning management system was the best path forward. The team chose TalentLMS as the vendor and customized the look and feel of the system to match the ACFW's branding and needs while following all accessibility standards required for effective learning for the targeted student population. The team worked with curriculum designers and the ACFW to build activities to support interactive learning and understand the best teaching methods for students with disabilities.

The team also developed a scheduled Python task to send reports with relevant data from TalentLMS to academic researchers, to assist in research efforts to audit the success of the curriculum. Reports were also created within TalentLMS for teachers to see the progress and academic performance within HealthyU. Additionally, the team worked with the Information Technology team at Lincoln Public Schools (LPS) to integrate single-sign on (SSO), allowing students to log into TalentLMS with their LPS credentials, saving time for students and teachers using this curriculum. The solution is expected to be piloted for research in Lincoln Public Schools classrooms in fall 2020.

Student Team

Gauri Ramesh
Jessica Smith
Khristina Polivanov
Ryan Wolff
Megan Wright

BUILDERTREND

Creating the New Face of Buildertrend

Buildertrend is a leading provider of software in the construction industry and has been since its inception in the 2000's. However, the development process at Buildertrend has been monolithic; this led to duplication between the APIs consumed by their mobile app and the WebForms front-end, which includes custom API work built into the front-end. The goal of this project was to help remove duplication between the two applications: web and mobile. To this end, the team migrated many pages from KnockoutJS and WebForms to ReactJS. This allows Buildertrend to have one API that is consumed by both apps, and makes the web app much more maintainable.

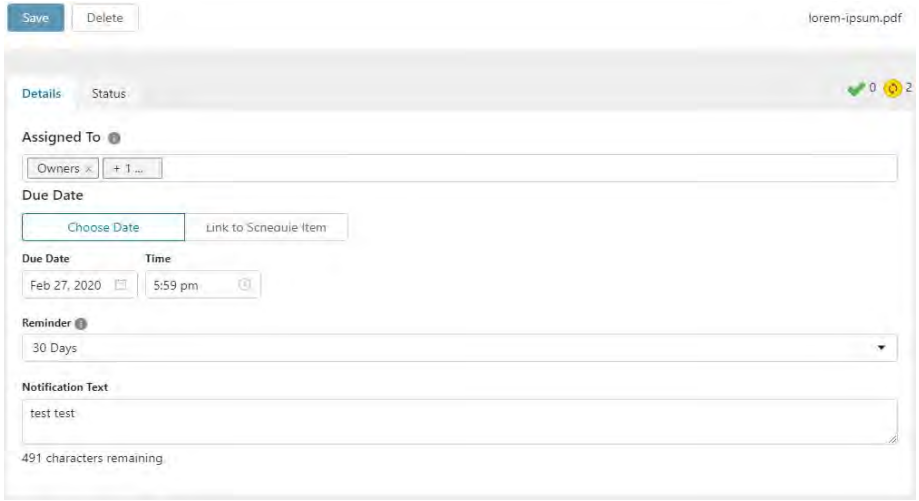
Buildertrend's app is so complex that the team's goal was never to convert the entire app, so they focused on targeting the highest priority areas. The team's original goal was to convert three pages. They exceeded this goal by making three complete pages, a common component, and a wrapper for displaying the Buildertrend logo variations. Multiple pages that they have worked on have upwards of 10,000 hits per month.

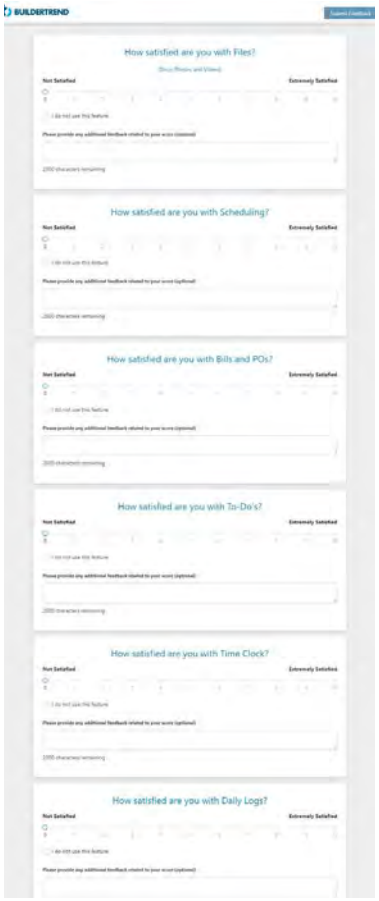
Additionally, once it became clear that the team would convert at least three pages, they researched a tool to help make the codebase more maintainable in the future. Chromatic, a User Interface regression testing tool, is designed to test individual "snapshots" in a web application to ensure that content on the screen does not change from version to version. Currently, changes are manually reviewed, and by adopting Chromatic as a part of the review process, Buildertrend can rest assured that it will know when breaking changes are created in the development process. Not only will this all happen automatically within a few minutes of creating the changes, saving hours of developer time, but Chromatic never misses any changes, in a way that humans don't. The team estimated that each time a change is created, Buildertrend would save around $1,000 in time costs to its design team.

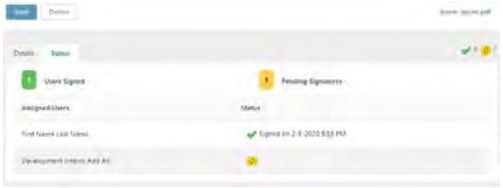
The team researched Chromatic and presented their findings to Buildertrend, where their proposal is now being reviewed by the teams that would use it to determine its viability in Buildertrend's codebase.

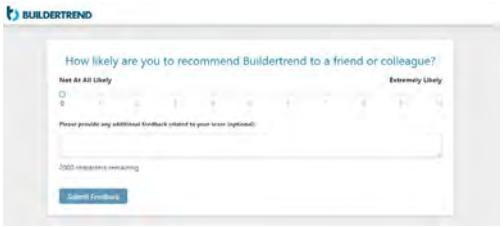
Student Team

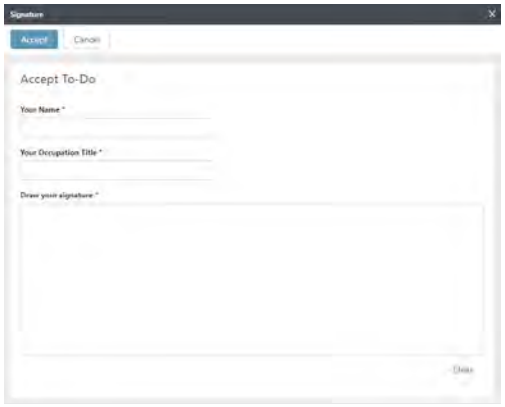
Joe Cowman
Brady Klein
Nathan Luchsinger
Jacob Shiohira
Christian Young
Brysen Reeser

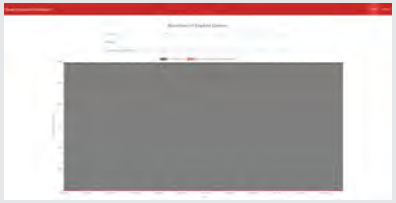












Modernize Data & Analytics at CSG

There are currently over 100 million queries on CSG's Oracle database. CSG is currently working on migrating these queries from Oracle to a Snowflake database. By doing so, CSG will be able to save millions of dollars by avoiding the fees associated with utilizing Oracle.

Our team assisted this translation in two keyways. The first was by building out a burndown chart to visualize this progress. This chart displays the number of queries that are still active or running on the Oracle database. This burndown chart was presented to users as a frontend web application. This application also showed the users information such as what specific queries remain in Oracle.

The second aspect of the team's work involved creating a translator between Oracle and Snowflake. The team did this by mapping out common Oracle to Snowflake translations and then by substituting those translations within the database. The team decided which words to focus on by performing data analytics on the database. Through this they were able to determine which words were most common and therefore, what words CSG would benefit most from having had translated.

Student Team

Emma Clausen
Reid Jones
Sean Fitzgerald
Daniel Guo
Jared Ladd
Anna Krueger

Dynamic Product Configurator with Matching Image

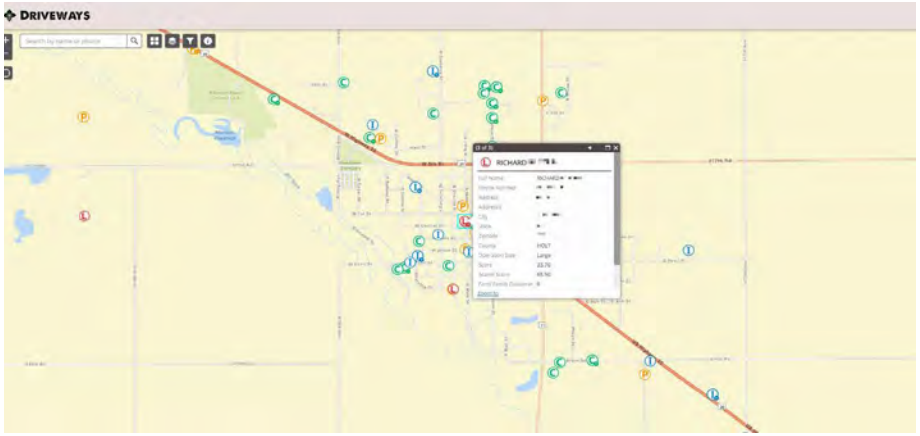
In the recent decades, the building materials industry has seen a shift toward providing more custom products due to changes in consumer preferences. Building material units such as exterior doors thus need to be customized and configured to specifications provided by end consumers or contractors in order to provide the best experience and range of products for customers.

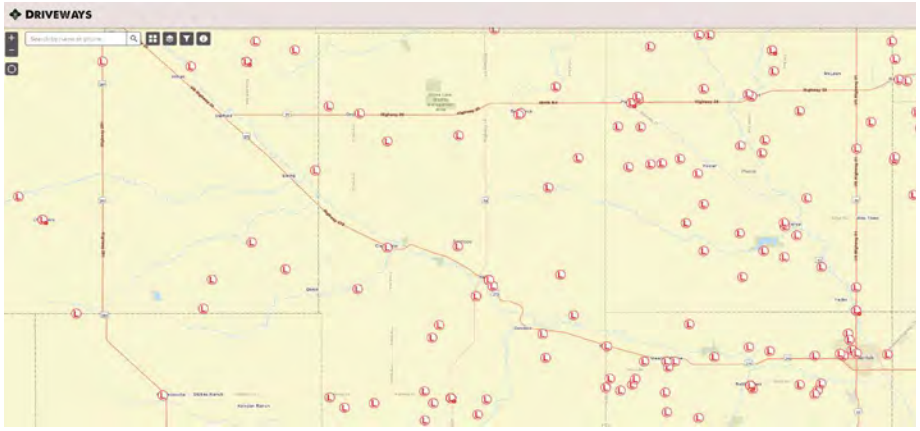
While DMSi's flagship product, Agility—an Enterprise Resource Planning (ERP) software package designed specifically for the building materials industry—does contain a version of a product configurator, two key setbacks exist: (1) the product configuration process is both linear and technically intensive, taking upwards of 10 minutes to configure a single exterior door, (2) this solution relies on a third-party service to generate a final image of the configured product, costing DMSi thousands of dollars annually.

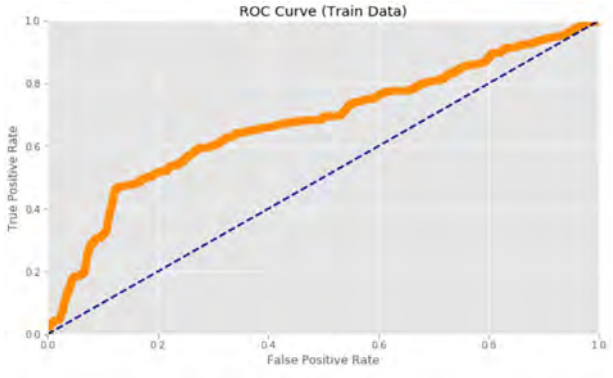
To improve this process, the team developed an image-driven, user-friendly product configuration web application that would bring all processes in-house and save DMSi's customers, and its customers' contractors, time and money. This resulted in (1) a service that dynamically generates a high-resolution image given a set of product attributes specific to the user's specifications, and (2) a feature-rich product configuration tool that enables users to visually explore hundreds of door component options, see real-time product image updates, and even preview the newly-configured door overlaid on an image of one's house. This new platform decreases exterior door configuration time by 60%, brings this feature stack in-house (enabling DMSi to control the product's future), and improves DMSi's bottom line. In addition, while this system was built specifically for exterior doors, it ultimately provides an infrastructure for DMSi's product customization tools beyond doors and propels DMSi forward as a leader in eCommerce for the building materials industry.

Student Team

Luke Bogus
Matthew Meacham
Akshat Goel
Maria Maxon
Nguyen Huy Vuong
Nathan Gentry







Farm Credit Services of America

FCSAmerica Lead Generation

The goal of the FCSAmerica Lead Generation project was to use machine learning and data science techniques to build predictive models that aid in identifying agricultural producers who can most benefit from the organization's products and services and to share this information with the sales team. The ranking algorithm generated scores for producers based on multiple weighted factors. Scores were then presented in a format that facilitated easy contact with a producer including being displayed geographically on a map within FCSAmerica's internal tools.

To successfully build this algorithm, the team developed a cleaning pipeline to read in these data sets containing hundreds of thousands of entries, clean the input, and output data suitable for use in building predictive models. To fully understand the holistic picture of each contact and build the most robust predictive model, there was need to join data across various datasets using fuzzing joining techniques. In this technique the contacts or leads were matched based on a confidence score of similarities between attributes such as name and address. The overall solution provides additional context around potential leads and the ability to prioritize them without accessing large data sets. The ultimate goal is to increase the conversion rate of the sales process by using data-driven insights.

Student Team

Jared Fuelberth
Brendan Owens
Mohamed Aly
Sam Futterman
Jacob Sullivan

GALLUP

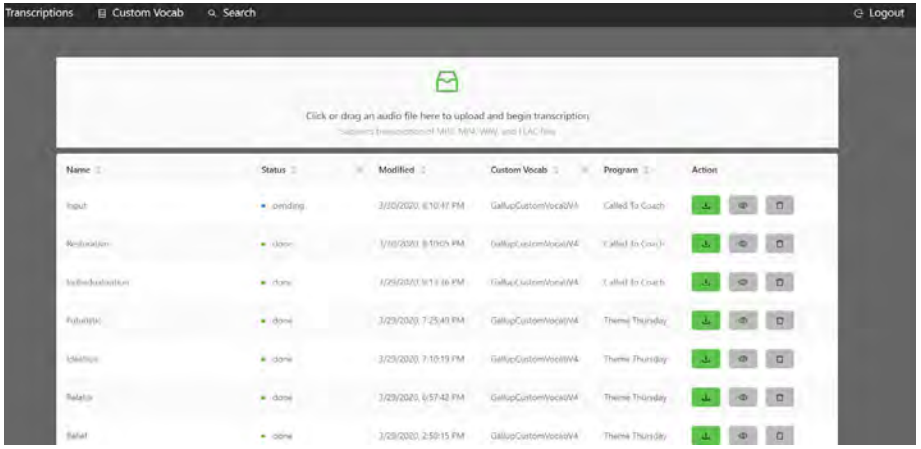
Recorded Audio/Video Search, Transcription, Translation and Insights Service

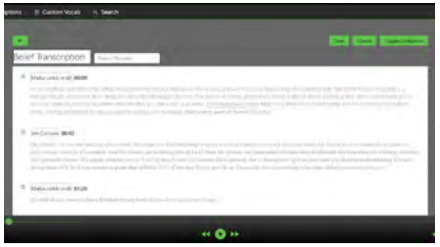
Gallup's company mission is to provide its customers with analytics and advice about everything that matters. One of the ways Gallup fulfills this mission is with its Clifton StrengthsFinder. The Clifton StrengthsFinder is a robust online assessment that helps individuals identify, understand, and maximize their strengths. It allows people to be their best selves by playing to their strengths at work and everywhere else. An important element of the value of this Clifton StrengthsFinder product is the education that Gallup provides to the people who have taken the assessment. Gallup has an extensive media library of videos and podcasts that discuss coaching, how to best leverage strengths, and other valuable information. These videos contain great and useful content but they are hard to access and search through.

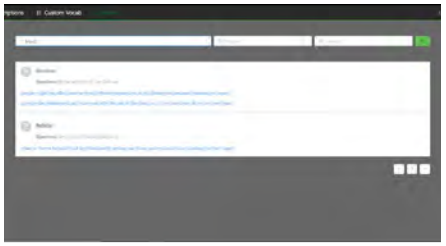
To address this difficulty the Gallup Design Studio team created the Transcription Insights tool. The tool takes in audio file uploads, and with the number of speakers and names of the speakers, it creates a speaker organized transcription of that audio. Once Gallup's full media library has been uploaded, users will be able to search through the transcriptions of all the videos. They can filter their searches by speaker and video program. This makes it easy to narrow down options to the information or quote that a user is after. Every search result also returns timestamps so users can find the moment in the video and watch from there or get an accurate cutting. An additional element of the tool that evolved to be very important to Gallup was the accuracy of the transcription. The application uses an automatic transcription tool, so flaws are inevitable, but the team gave Gallup several features that allow them to tweak it by hand. This application contains a custom vocabulary that will enable Gallup to install an autocorrect for the most frequently misinterpreted words in their transcriptions. For example: "gallop" can automatically change to "Gallup." They also can edit all transcriptions manually. Using our tool, Gallup customers and marketing team alike can easily search through their video material.

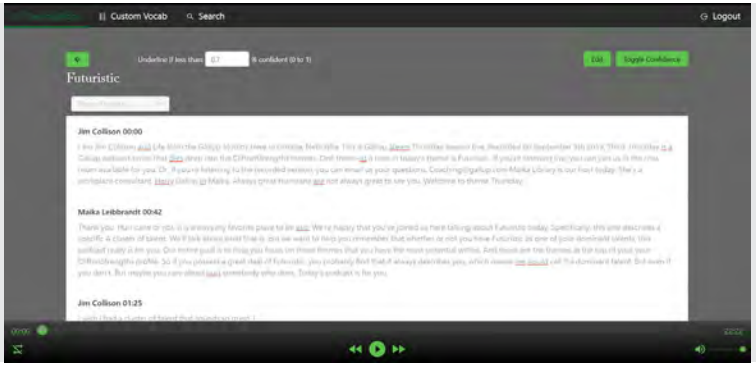
Student Team

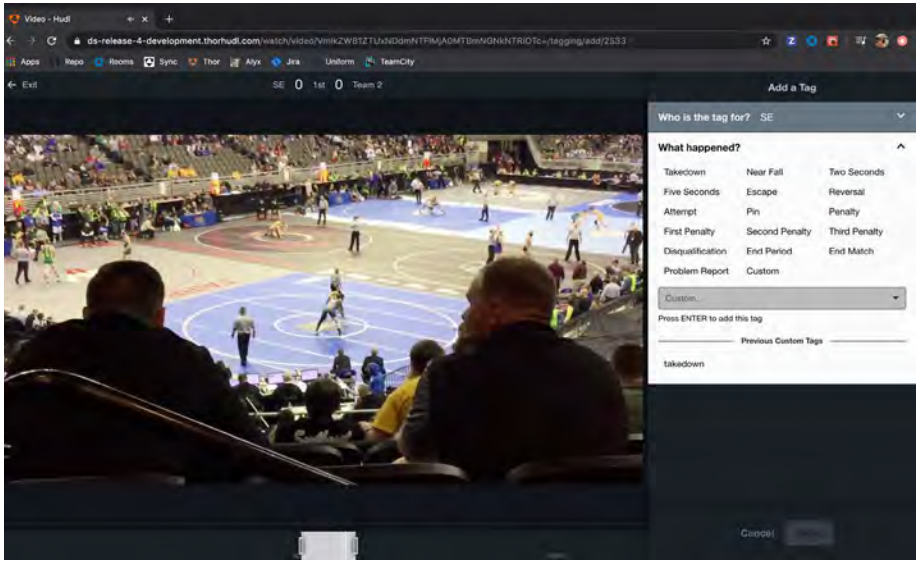
Zak Keck
Mary Clare Rogers
Allen Junker
Rahul Prajapati
Nathan Ullman

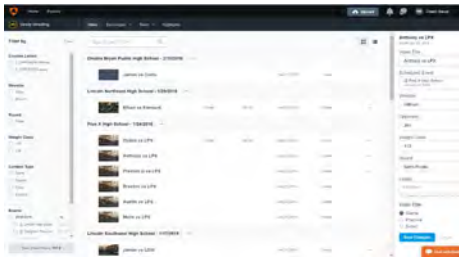


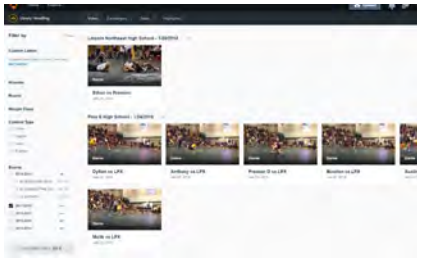


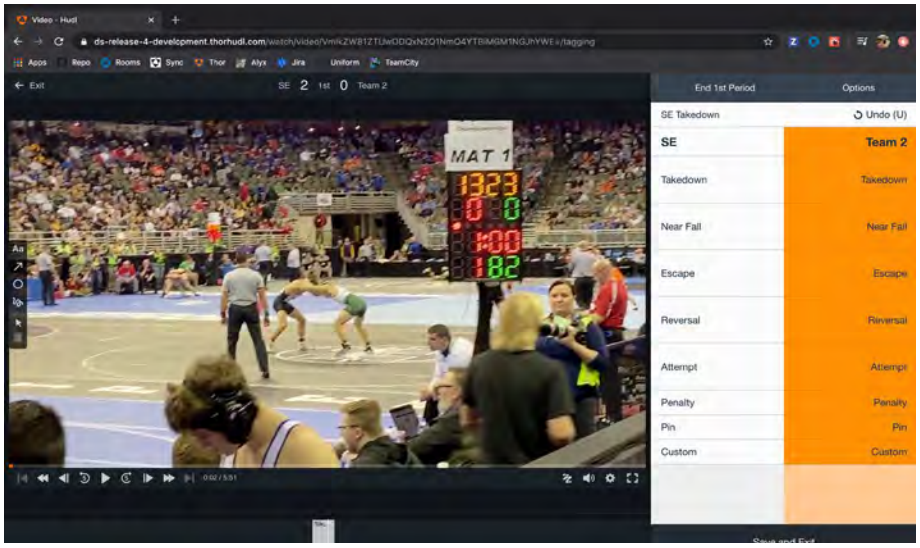












Wrestling Video Analysis

Hudl has made a name for itself in providing athletes and coaches in the most popular sports around the world with the ability to capture, organize, and analyze their game and practice film. These sports include football, volleyball, basketball, and soccer, among others. However, there is one sport that Hudl has yet to add to its platform: high school wrestling. This is due in large part to the complexity of adding an individual sport to Hudl's platform, which was designed and built around team sports. Hudl tasked Design Studio with developing a tool within their existing platform that could help high school wrestling coaches and athletes improve their ability to manage and analyze their film.

To go about developing a product that could be used by wrestling programs across the country, the team elected to begin interviewing coaches to determine what features would help them most. The team landed on three major features: an improved video library, event tagging within videos, and statistics reporting based on event tags. Once the features were decided, the team developed mockups and tested them with users to ensure they would be useful.

The team was able to successfully implement the three major features for an MVP of wrestling functionality within Hudl's platform. Using this product, wrestling teams are able to upload their film directly from the Hudl app onto their team's video library. Within the library, their film is organized by event (tournament, meet, dual, etc.). These videos can also be filtered by wrestler or weight class, giving teams the ability to quickly find specific clips in their library. The teams can also analyze each of their clips for various events such as takedowns, pins, and attempts. Coaches can then create statistics reports based on the tags they have identified within their videos.

Student Team

Austin Hillman
Sheng-Jie Lim
Dom Giandinoto
Connor Jolley
Ben Stuart
Zac Streich

Kiewit

Material Tracking System

Due to the sheer size of Kiewit's construction sites and the large amount of material being moved every day, it is not uncommon for items to be misplaced. This often causes parts to be reordered or personnel to spend unnecessary time searching for the missing parts. Because of this, Kiewit came to the Design Studio team requesting a system that allows them to capture materials at the time of receipt and apply a tracking mechanism that can be associated with that material. Later, when it's time for a site to utilize the material, the system should allow item location to be tracked via mobile and desktop devices.

The solution was a full stack system that would allow construction workers to more easily find their materials. The hardware for the system involved "tags" which are small devices that are fixed to construction material. These devices communicate over Bluetooth Low Energy (BLE) to "masters", other small devices that are distributed throughout the laydown yard such that the entire laydown yard is within the BLE communication range. These masters are Internet of Things (IoT) devices that send MQ Telemetry Transport (MQTT) messages over Wi-Fi to Azure IoT Hub. The content of these messages includes GPS coordinates and the nearby tags. From there, the messages are processed by our C# application and rendered on the front end. The application also has a database for persisting information between updates received. The application can also send messages through IoT Hub down to masters.

To use this application, masters are associated with a "site" when activated and all data from that master will be associated with that construction site. Then, individual tags are activated and registered with the material that they are attached to. Material can then be moved freely about the laydown yard until needed. When workers want to find material, they search for it on the application to find the GPS location of the nearest master. After that, they can press a button on the application to make the tag on their material beep, which will get them the last 20-30 feet. Once they collect their material, they can remove the attached tag and place it in a bin for later reuse.

Student Team

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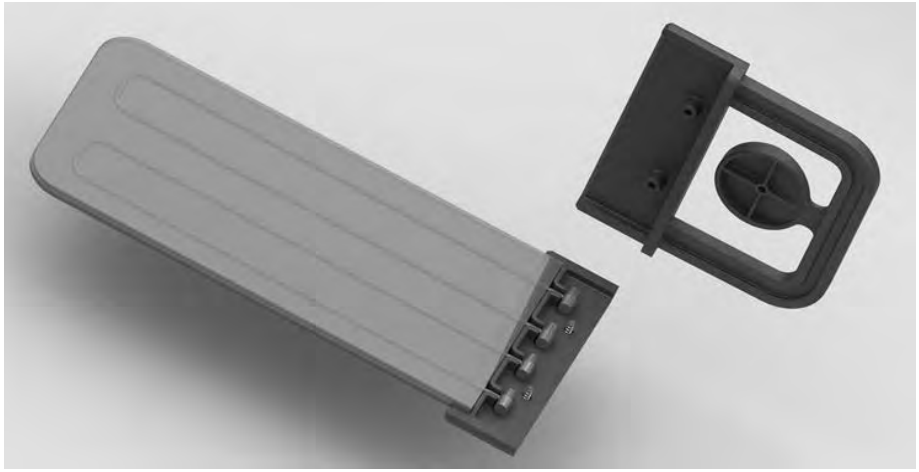

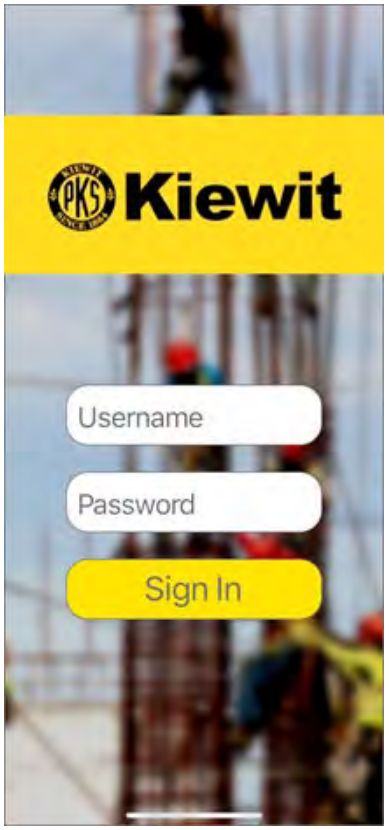

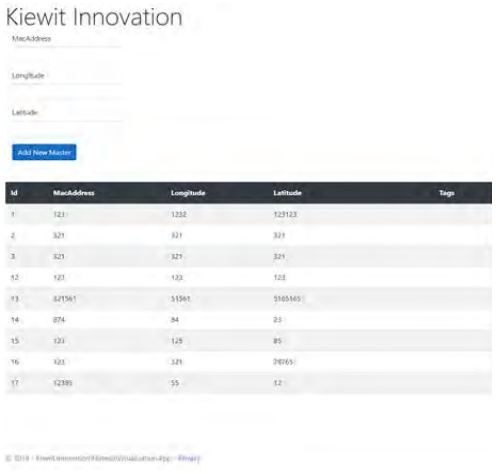

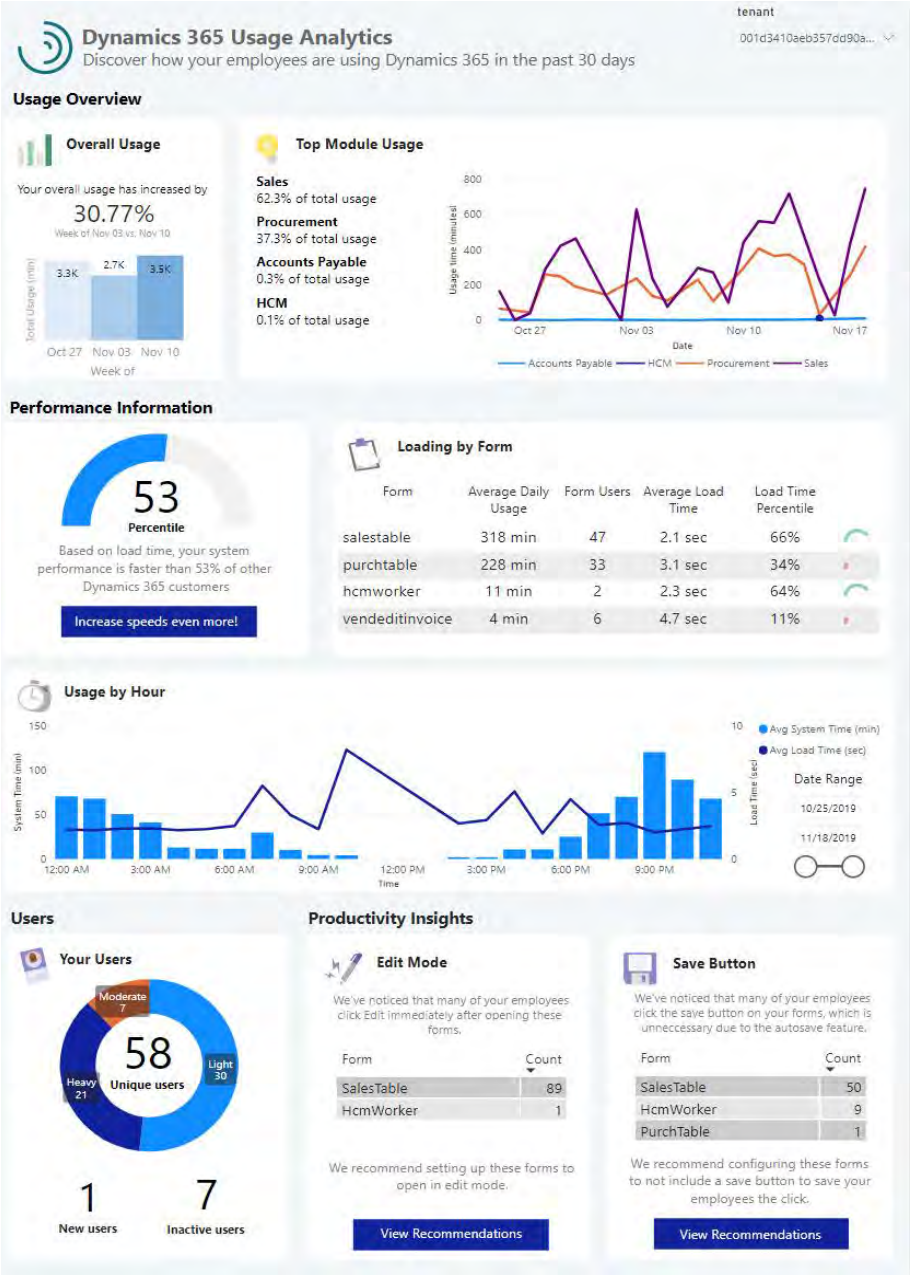

Microsoft

Optimizing the Dynamics 365 User Experience

Microsoft's Dynamics 365 for Finance & Operations is a product line of enterprise resource planning and customer relationship management applications. These business applications work together seamlessly to help run an entire business. Dynamics 365 provides a static user experience, which is then implemented and customized by third-party partners to meet the specific needs of a customer. The third-party partner also trains the customer's employees on how to use the system. Customizations and trainings aren't always done well, and users are often left on their own after the initial setup is complete. Further, if customizations aren't done well, users may see a decrease in system performance. This leaves System Administrators at Microsoft's customers wondering why their system isn't performing as expected. Microsoft wants to directly provide System Administrators with tools to understand how their system is performing and suggestions for improving the experience.

The team worked to analyze and transform more than 99 million telemetry logs collected over the period of one month to make a dynamic view of the user experience a reality. Using the results of this analysis, the team built a Power BI dashboard for System Administrators of Dynamics 365 with weekly usage trends, performance information, usage by module, and productivity insights. System Administrators can see how their instance performs relative to other Dynamics 365 customers and receive recommendations for improving productivity and overall experience. These insights will allow System Administrators to locate inefficiencies in the system, prioritize the issues that are affecting the largest number of people, and implement solutions readily. System Administrators will also be able to make better decisions regarding automation by understanding when the system load is the heaviest and moving automated tasks to minimize the impact on users.

The team built a data processing pipeline that can efficiently handle the millions of telemetry logs received by Microsoft each day to support the Dynamics 365 Finance and Operations Usage Analytics Dashboard. The team also worked on a set of deployment artifacts that will allow Microsoft to quickly deliver this report to customers, allowing System Administrators to implement timely and effective changes to their Dynamic 365 environments.

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AIOps

When a large company like Mutual of Omaha experiences a server outage, thousands of customers and associates are impacted. Mutual of Omaha estimates that each hour of server failure can cost up to $450,000 in lost business income, lost working hours, and customer dissatisfaction.

If teams were aware of issues beforehand, they would be able to proactively work to mitigate the server's issues before it caused an outage.

The Design Studio team worked to create a machine learning model to predict outages within 24 hours before their occurrence, as well as an alerting system to notify Mutual when an outage is predicted. Through a supervised learning time-series model called an Autoregressive Integrated Moving Average (ARIMA) model, the team used past error logs to predict future error levels. If the predicted error level of the server is significantly higher than the typical levels of the server, the system sends out an alert to Mutual of Omaha, listing the server predicted to fail and the predicted failure time. In addition to the ARIMA model and alerting system, the team created a web application to document the alternative models tested, valuable insights from the data, and details of the project for onboarding.

Student Team

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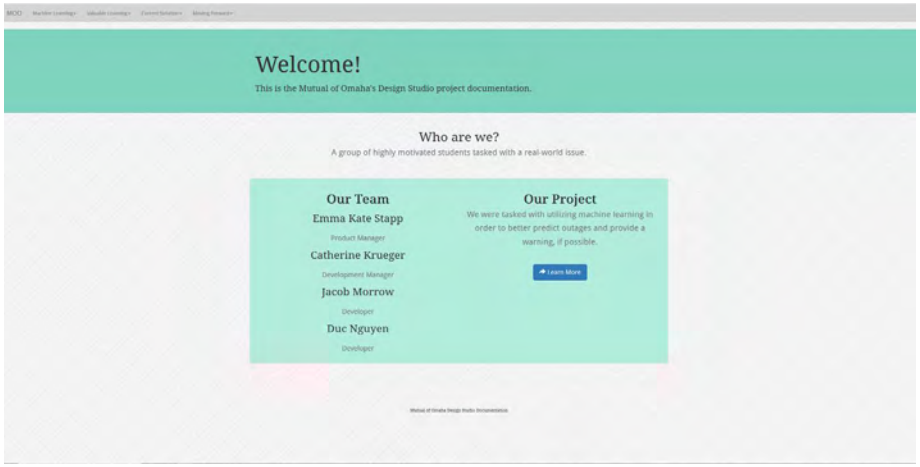

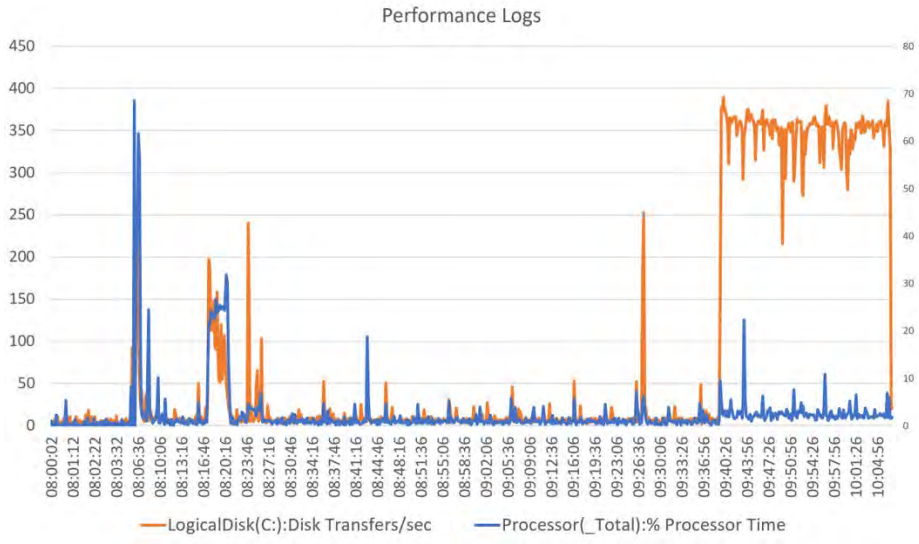

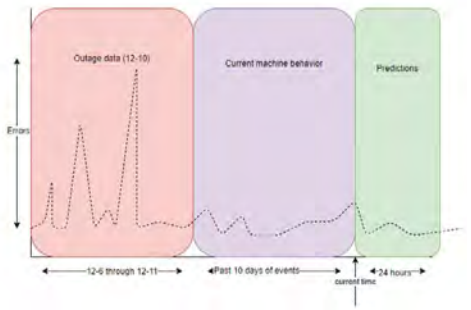

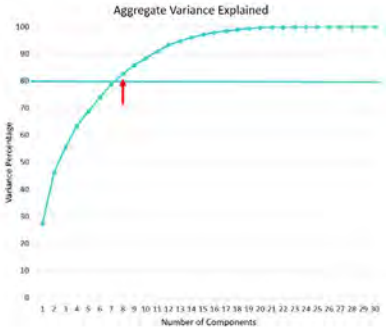

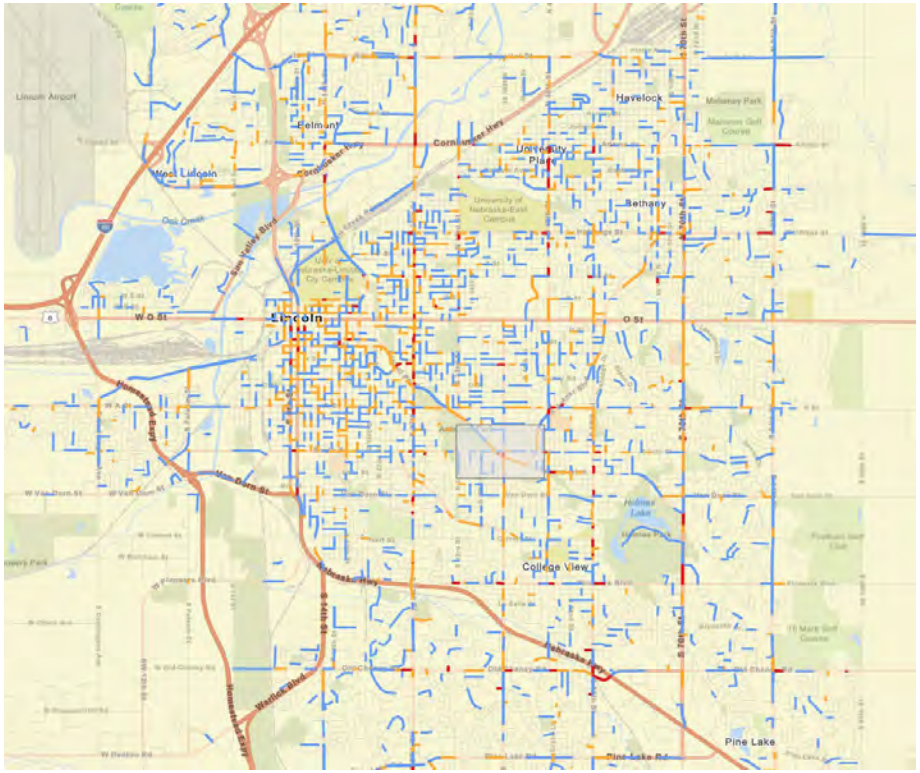

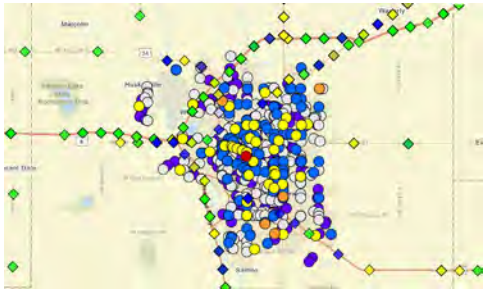

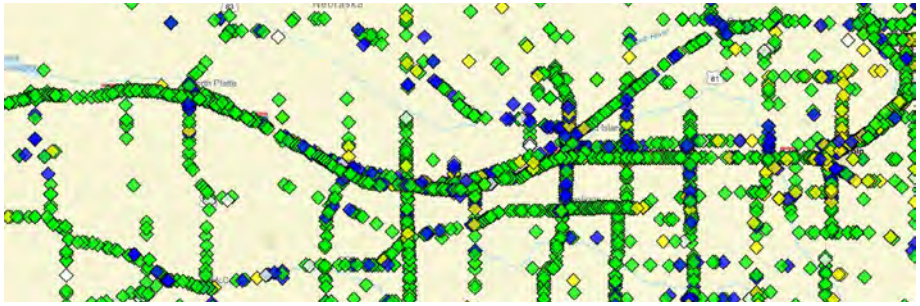

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

Nebraska Transportation Information Portal Phase 3

Government agencies rely on the Nebraska Department of Transportation (NDOT) to provide road project recommendations based on crash and traffic trends. These recommendations are used to design safer and more efficient roads, saving lives and money. To identify these complex trends, analysts have to be able to visualize trends from a state-wide view all the way down to an individual intersection view. These visualizations occur through spot maps at the highest level and crash diagrams at the lowest, which render query-specific crashes over a Nebraska map and within a drawn intersection, housed in the Nebraska Transportation Information Portal (NTIP). These visualizations, in the present-day workflow, are time-consuming and tedious. A single spot map may take upwards of 10 minutes and contains visual clutter. Crash diagrams, which are auto-generated, are riddled with poorly rendered roads and misplaced crashes. Analysts must spend their time combatting these issues, which directly trades off with how much time and effort they can focus on adding important insights.

This project refines NTIP by adding new tools and automating processes for analysts to take advantage of. The Design Studio team accelerated performance, added new visualizations to reduce clutter, enhanced rendering, and implemented intelligent crash placements to emphasize crash patterns. Furthermore, the team secured the system so that government agencies can directly interact with the application with unique data and workflows. Less time is spent fighting the application and more time can be focused on drawing value from it – bringing new efficiency and value to Nebraska tax dollars.

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PaymentSpring Gateway

Interchange (IC) fees are charged by credit card processors (Visa, Mastercard, and Discover) and is the largest expense attributed to a merchants monthly processing costs. IC fees are calculated through a blackbox algorithm that takes into account the card brand, rewards level, and other variables. This fee is a non-negligible expense that companies must monitor as an important line-item on their income statement. Another caveat to interchange is the existence of downgrades, or transactions that are "downgraded" to a higher rate due to lack of information, processing time, or other numerous reasons. The challenge for this year's PaymentSpring Design Studio team was to design and implement a tool that allows PaymentSpring's Partners to view, understand, and influence their interchange fee experience.

The solution developed by the team has three distinct components to achieve these goals:

Interchange Dashboard: The interchange dashboard is an interactive, visual resource for Partners to get a snapshot look at their interchange experience. It includes a line graph demonstrating a Partner's effective interchange rate over time, a histogram displaying the distribution of rates that transactions fall into, a stacked bar graph that breaks down total interchange fees into typical transactions and downgraded transactions, and a table that provides further details about each merchant a Partner works with.

Interchange Education: Interchange is an extremely complex topic with rules that are continually evolving and changing. The team chose to include an interchange education component to educate PaymentSpring's partners on the nuances of interchange and to provide them with a more thorough understanding of how and why it impacts their bottom line. Through an initial splash-page with overarching information, tool-tips on each dashboard component, and an FAQ page with the more nitty-gritty, this resource helps Partner's gain a better understanding of interchange.

Data Insights: Although understanding a snapshot of experience is important, it is more important to discern trends and changes in data. Data insight notifications notify a partner of fluctuations in average effective rate, total interchange fees, and downgrade count. These notifications include the specific date range during which the change occurred, and also provide information regarding why that change might have occurred so that Partners may take actionable steps to improve on the experience.

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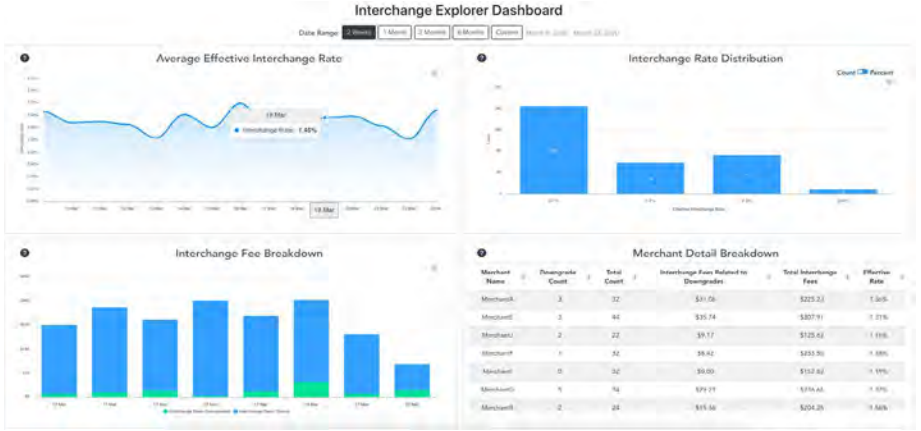
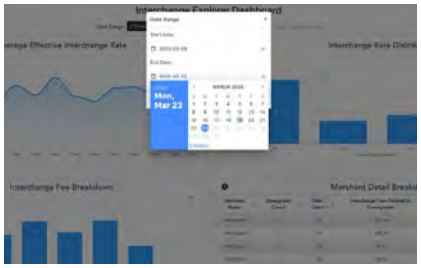
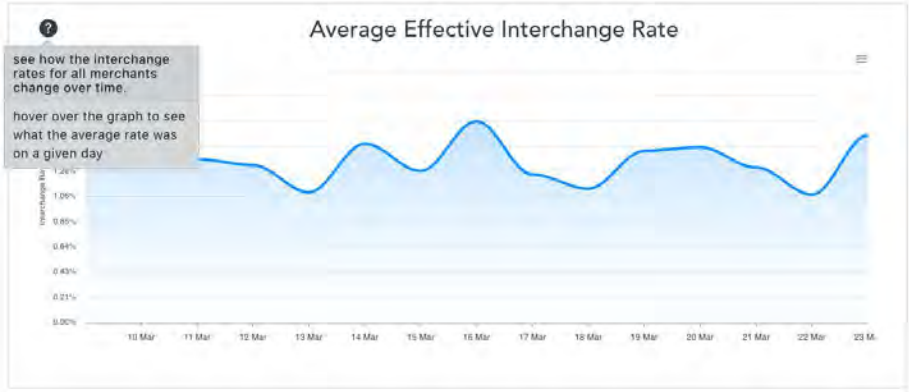
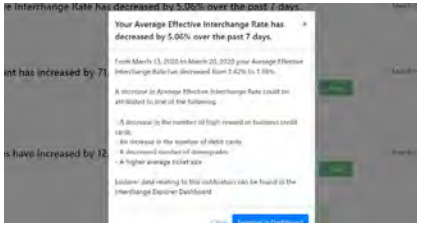
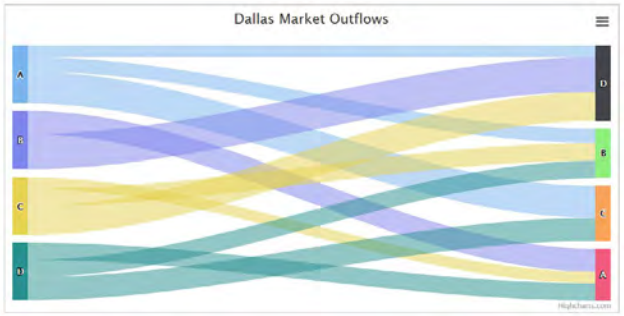


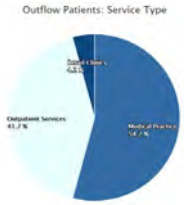


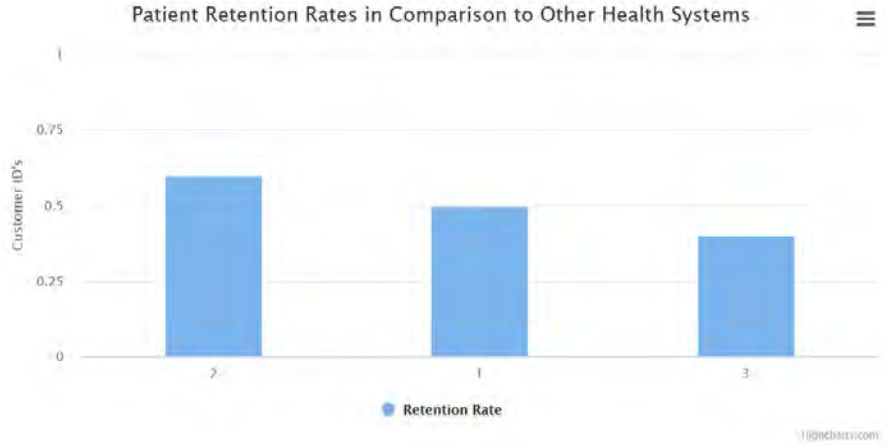




A basic column chart compares retentation rate percentages between four quarters. The chart is making use of the axis crosshair feature, to highlight quarters as they are hovered over.







nrc HEALTH

Loyalty Insights

One of the biggest concerns of health systems is to know how they can better serve their patients. Health systems seek to exceed patient expectations and inspire patients to return to their system for all their health needs. A patient who returns can be considered loyal to that health system.

NRC Health collects patient data from over 9,000 health systems across the country. This allows it to provide data insights that inform health systems' decisions. The ultimate goal is to increase patient loyalty for health systems by helping them understand how to serve their patients better.

The team was tasked with using data analytics to find insights about patient movement between health systems. The model shows a health system's patient retention as well as the top health systems to which patients are switching. NRC Health can then use the underlying data to identify possible causes for the switching behavior. Through this model, NRC Health hopes to provide health systems with a better sense of how their patient retention compares to the market, estimate revenue loss due to switching behavior, and suggest ways to improve the patient experience.

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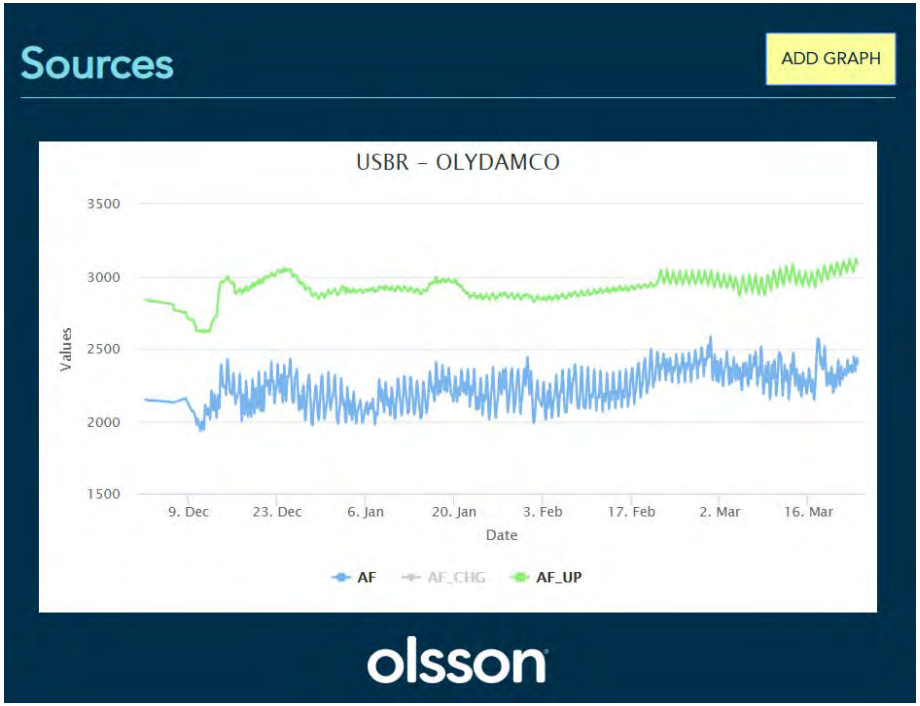
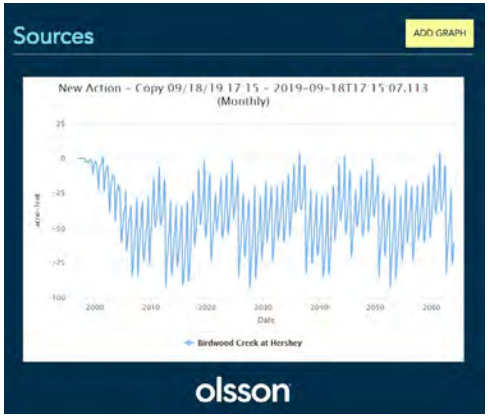
Groundwater Sustainability Platform

Olsson is a nationally recognized engineering firm that offers design and consulting services in planning and design, engineering, field service, environmental, and technology. In association with Olsson, the Design Studio team provided the Twin Platte Natural Resources District (NRD) greater transparency into the region's groundwater by engineering hardware and developing a dashboard to monitor groundwater levels, streamflow, and other important metrics. Groundwater managers at the NRD are tasked with protecting and sustaining groundwater resources in the region to supply to local communities and, most notably, farms. Consequently, augmenting and visualizing available information on the state of groundwater in the NRD is critical to farmers and citizens, all of whom depend on reliable access to water resources.

The team developed a data flow pipeline beginning with custom hardware to be installed on the thousands of well pumps across the NRD. This hardware comprises a water contact sensor, a wireless communication device, a pump state monitor, and a power delivery and consumption solution. These devices measure groundwater level using a novel solution developed by the team, defined as the Time-To-Surface (TTS) Model. This model calculates groundwater level based on how long it takes for water to be pumped up a well shaft, pipe diameter, pump horsepower, and other variables. These devices also tout a battery life of five years, with an optional solar power attachment. Data from the devices are communicated along a wireless network hosted by Paige Wireless, a dedicated partner of the project, to Olsson systems.

The team also developed a dashboard to aggregate and view groundwater data that is pertinent to groundwater management operations. This dashboard scrapes data from the Nebraska Department of Natural Resources, the US Bureau of Reclamation, the Platte River Program, the US Geological Survey, and Olsson's Groundwater Evaluation Toolbox to provide a complete picture into the state and behavior of groundwater in the NRD. Users of the dashboard are able to view multiple data sources simultaneously in a tile-based arrangement or selectively deep-dive into a particular data source. Instead of spending several hours shuffling through several websites, spreadsheets, and other documents, groundwater managers can enjoy this first step in consolidating all the data they need to one location.





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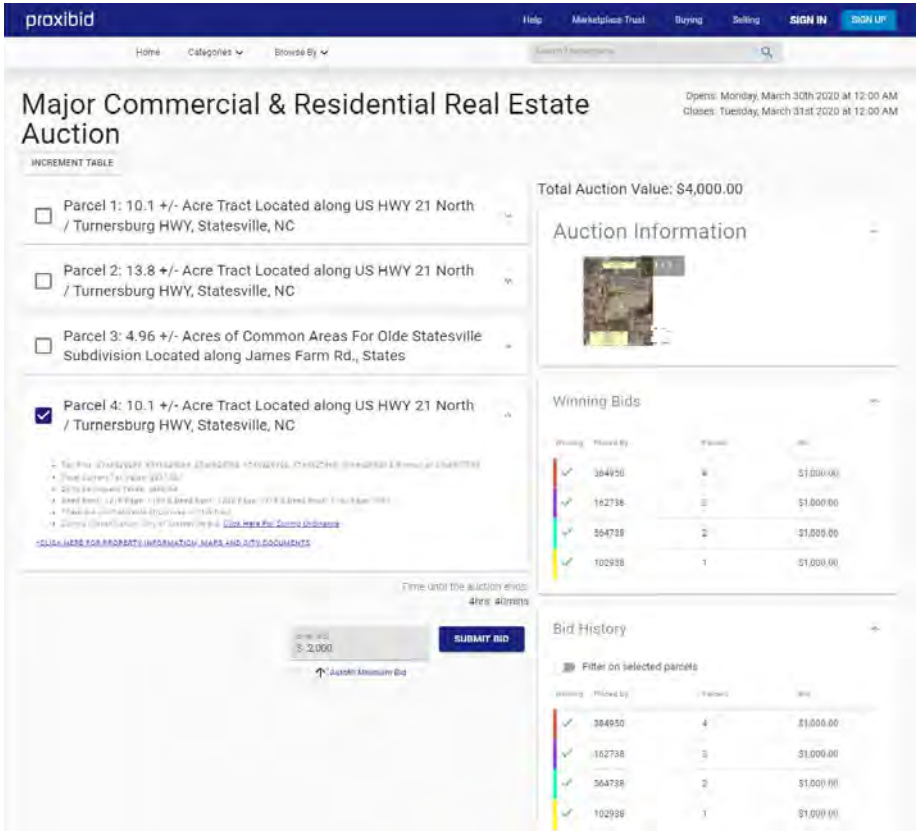

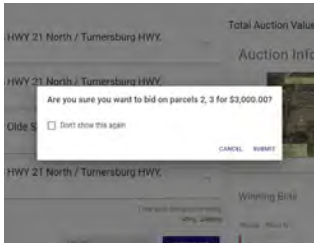

proxibid

Multi-Par Auction

Proxibid is an online auctioneering company that is known for hosting high-value items, such as cars, antiques, and estate sales. This year, the Design Studio team was tasked with creating a new auction system for Proxibid that allowed them to host multi-parcel auctions. A multi-parcel auction is where bidders are able to place a single bid on multiple individual items. These auctions are typically used when selling lots of individual parcels of land.

The Design Studio team created a core system that allowed Proxibid to host multi-parcel auctions on their website, then they added more value to the system by creating a heads-up display (HUD). This HUD allows auctioneers to mark out the different parcels on a map, and it constantly updates so bidders know who is winning which parcels. The Design Studio team developed the core system with many unique features, including finding the minimum price on selected parcels, easy use between home computers and mobile devices, and ensuring transparency with pricing.

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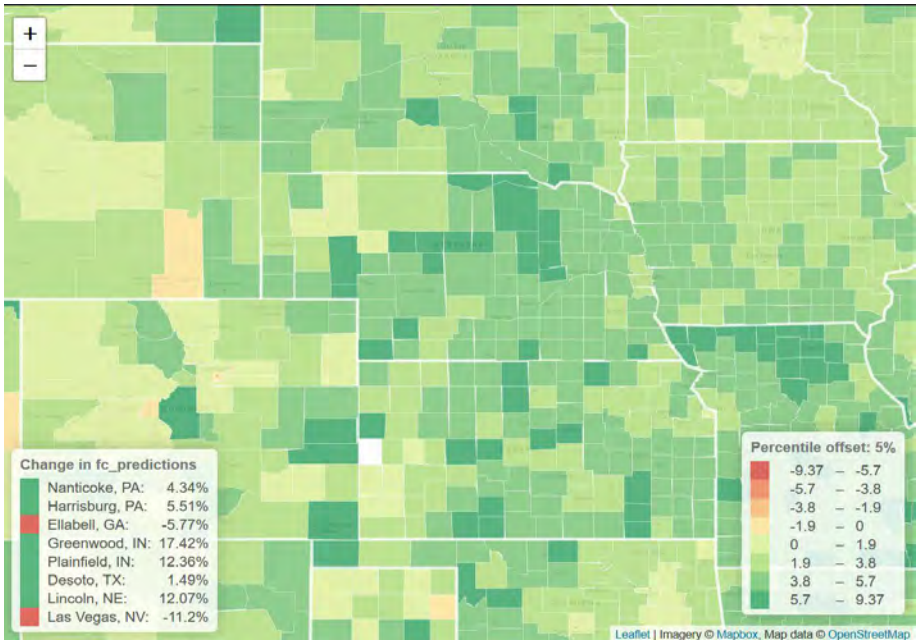
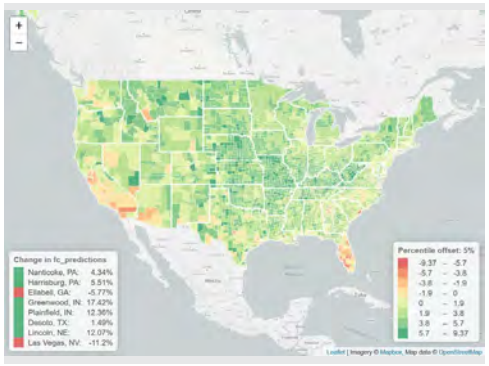
Spreetail

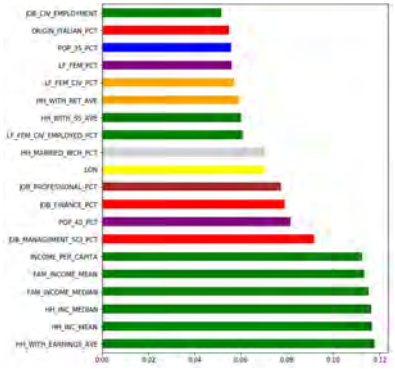
ML-Enhanced Business Intelligence

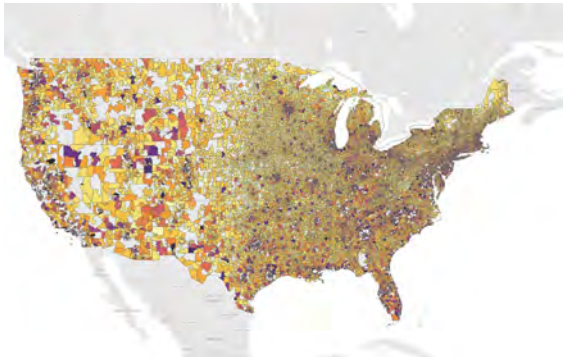
Spreetail is an e-commerce company that is currently operating with eight fulfillment centers and sending orders across the United States. These fulfillment centers are designed to optimally service specific regions of the United States. One of Spreetail's continual challenges is accurately predicting and understanding what is driving the company's regional demand. Spreetail currently employs a large supply planning team that attempts to understand where demand is coming from and what is driving it. The Design Studio team was thus challenged with using Spreetail's vast amounts of data collected from across its operations to provide actionable operational insights. The team then embarked on creating a solution to aid in the accurate estimation of the company's fulfillment center level demand.

The solution is a machine learning model that generates insights into the effects of demand on a given product based upon changes in qualitative and quantitative factors. The model has further been abstracted into an API that allows the insights to be incorporated across a wide variety of applications at Spreetail. The team has also developed a sensitivity analysis user interface that allows analysts to break down demand influencing trends across individual products and roll the insights up to a fulfillment center level to understand how different scenarios will impact supply planning decisions.









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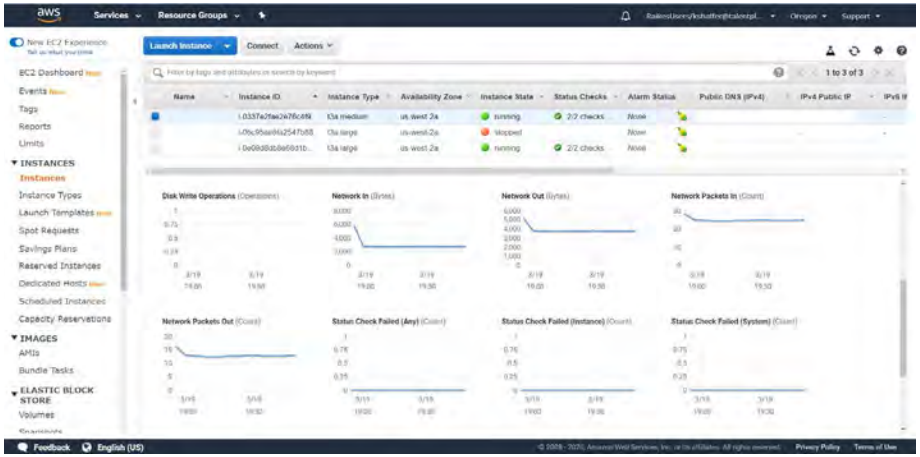

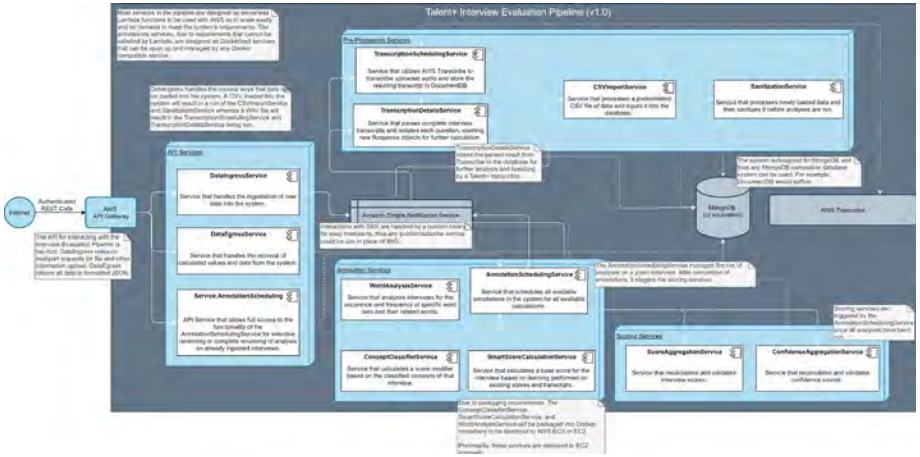

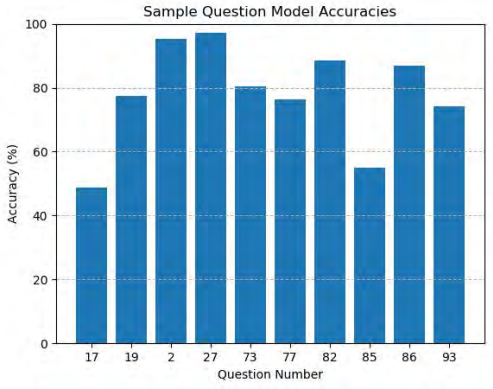

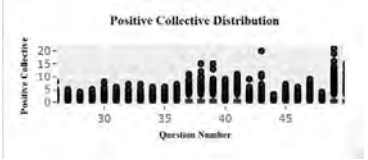

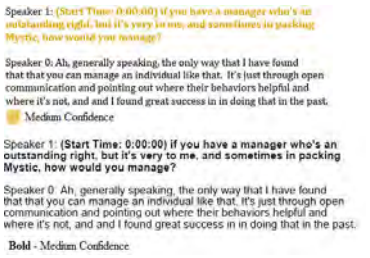

Talent+®

Natural Language Processing

Talent Plus is a management consulting firm with over 400 clients in 20 countries that has developed reliable, validated instruments to allow clients to assess an individual's aptitude to perform a specific job with excellence. One of its functions is to create structured interviews based on research and analytics. Currently, the interview evaluation process is entirely manual and the scoring portion is completed by analysts holding a Masters or a Ph.D. Interviews are conducted over the phone and recorded. Then they are transcribed to a Word document and sent to an analyst for scoring and evaluation. The interviews typically last between 2 and 3 hours, and the transcription and scoring both take between 4 and 6 hours each. Meaning the entire process for a single interview takes between 10 and 15 hours to complete.

The team developed a system that takes an audio file as input, automatically transcribe it, and outputs the transcript in either a markdown file or a Word document in 20 to 30 minutes. This will allow transcribers to focus on the words/phrases that are difficult for AWS Transcribe to understand rather than having to listen to the entire interview. This new process is expected to reduce transcription time by 800-1,800%.

The system also accepts transcriptions in the form of a spreadsheet as input. Once given a transcription to evaluate, the system will remove extraneous words and punctuation before passing it to analysis and evaluation tools: word analysis and scoring. Interviews are scored by leveraging supervised learning techniques to create models for each particular question. All of the individual scores are aggregated to a value that is 77.45% accurate compared to the analyst's scores. The other analysis tool takes a list of words and phrases and calculates the frequency of the usage of each item and the location of the item in the interview. This tool will allow Talent Plus to evaluate the correlation between a variety of patterns and interview scores that could be used to predict success. The system takes about 2 minutes to complete a single interview, an increase of 12,000%-18,000% from the manual evaluation method.

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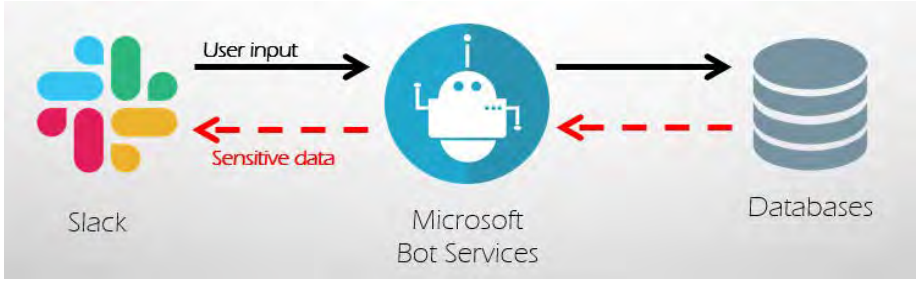
TD Ameritrade

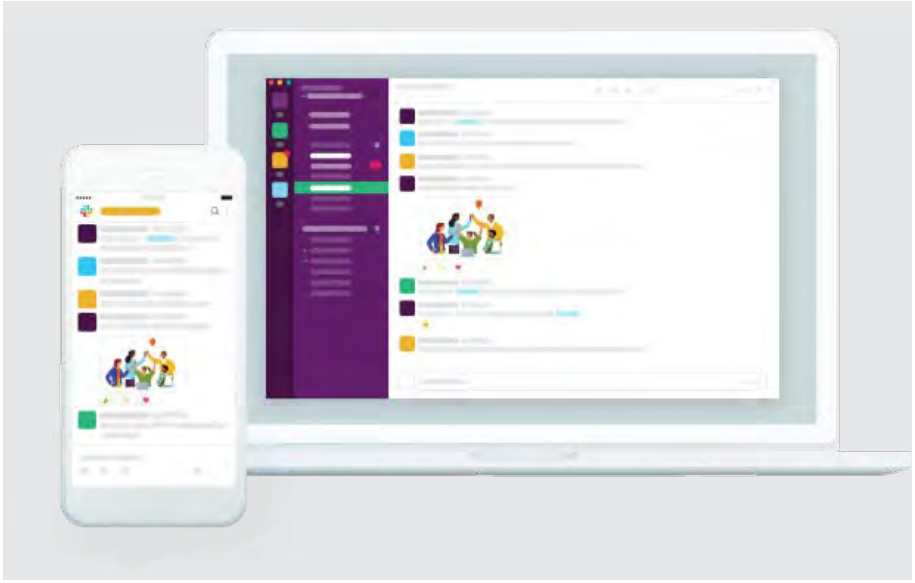
Virtual Assistant for Metric and Performance Retrieval

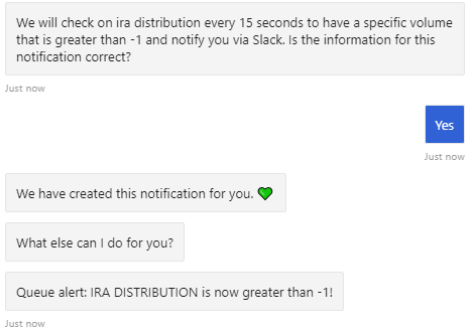
TD Ameritrade processes over 650,000 trades per day on the stock market and has over 7 million active users. With how quickly and unpredictably the stock market can shift, TD Ameritrade executives need access to accurate data at any given moment. There is no simpler way to do this than to speak out loud to one's computer, "How many tasks still need to be done today?" TD Ameritrade came to Design Studio looking for a virtual assistant that can be integrated with voice and messaging devices that can quickly answer any associate's questions.

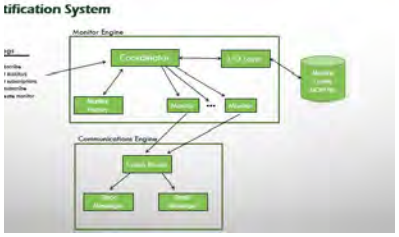
The Design Studio team developed a bot using a Microsoft Bot Services and Node.js tech stack. The team chose Microsoft Bot Services because it allows for native integration into other communication channels. Without any code changes, the team's solution can be integrated into a voice assistant, Slack messenger, as well as Windows 10 Cortana. This allows TD Ameritrade associates and executives to ask the bot questions anywhere they are: from their office, laptop, or through their phone.

The bot allows users to ask it simple data retrieval questions and receive an answer in seconds. Data extrapolation features were also built into the bot, allowing a user to get estimates on future values of a desired metric. Additionally, the Design Studio team built out a notification system that users can easily subscribe to through voice and be notified whenever a metric exceeds a certain value or changes too rapidly. These features are ideal for the Brokerage Operations department of TD Ameritrade, but they were designed to be easily expanded upon. Ideally, this solution can be adapted to meet many more needs of TD Ameritrade's daily operations.









Student Team

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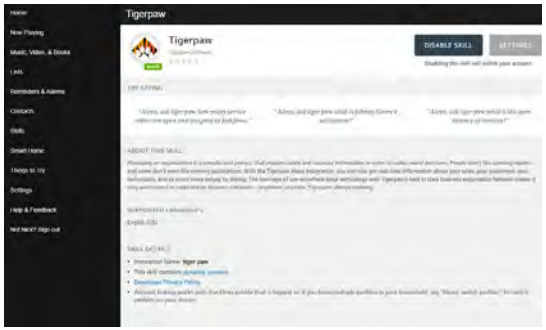
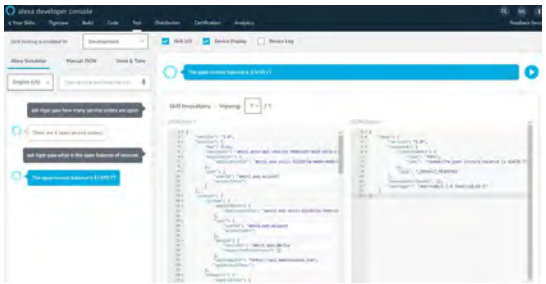
John Harkendorff
Aayush Khatiwada
Beibei Xiong
Adam Zastrow





Tigerpaw Software + Alexa

Tigerpaw One is an award-winning business automation software from Tigerpaw that empowers businesses worldwide to better manage their customers, increase revenue and improve operations through automating key processes within their organizations. However, voice-enabled technology is changing how businesses demand to interact with their data, and businesses are increasingly dependent on access to timely data when making decisions.

Tigerpaw's customers are businesses run by leaders who often are too busy to or choose not to login to their Tigerpaw system to get critical information about their business. Enabling these business leaders to ask Alexa for information about their business or perform functions within our platform using voice commands can save them time and ensure they aren't missing out on key metrics or events.

The team was tasked with delivering an Alexa Skill to Tigerpaw's business customers that could enable them to query real-time data about their business with their voice. As part of this project, the team was asked to interview Tigerpaw customers, build an engine for Tigerpaw Alexa voice commands, introduce new endpoints to the Tigerpaw REST API, engineer a secure Alexa authentication system based on the existing Tigerpaw authentication framework, and deliver a logging system to Tigerpaw that allows them to understand what real-time data their customers are asking for.

Because of the team's efforts over the Design Studio year, an official Tigerpaw Alexa skill consisting of four rich voice commands is now in Beta. Tigerpaw plans to introduce new command functionality and roll the Skill out to more of its customers in the near future.

Student Team

Gregory Nail
Nick Siscoe
Ruben Aguilar
Dana Hoppe
Rohan Thakker

DESIGN STUDIO STATISTICS

Project Technologies

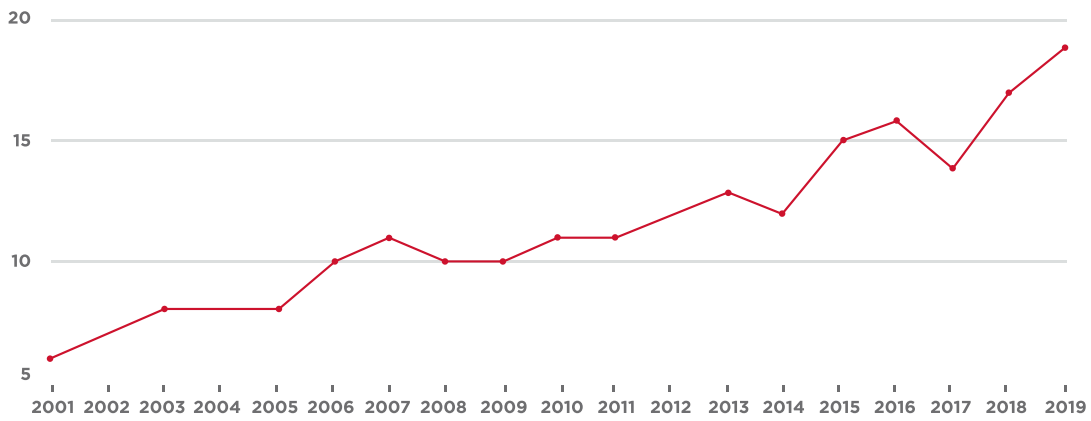
Cloud Providers

- Azure
- Other
- AWS
- Google

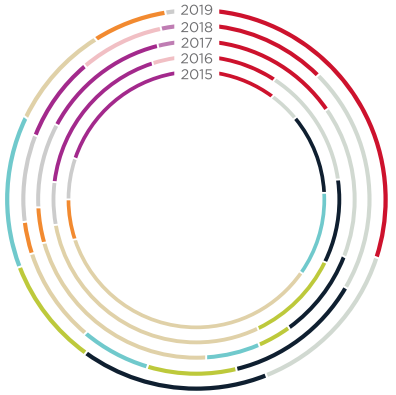
Software Used

1. amazon alexa, aws, C++, elasticsearch, Razer, GraphQL, Rails, Vue.js, Webpack, Windows Azure
2. C#, jQuery, Jupyter, mongoDB.
3. node.js, R, TypeScript
4. JS, python
5. Windows Azure, Microsoft .NET
7. React

Project Count

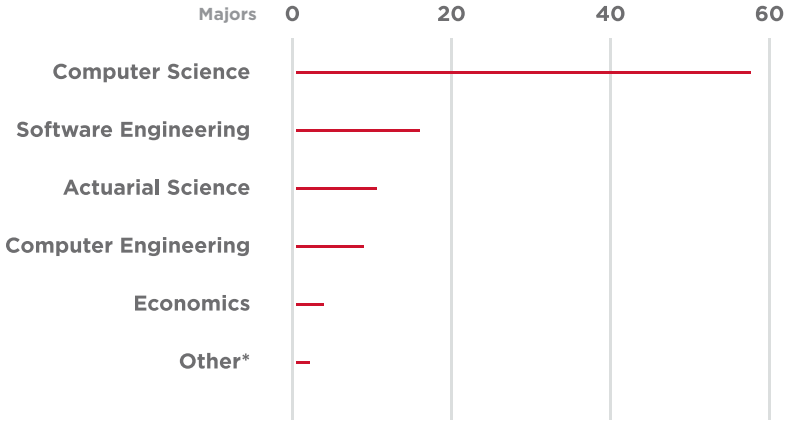


Project Domains



- Analytics
- Data Visualization
- Machine Learning
- Natural Language
- R & D
- Web Development
- Embedded Systems
- GIS
- Mobile
- Machine Vision
- Internet of Things

Programs of Study

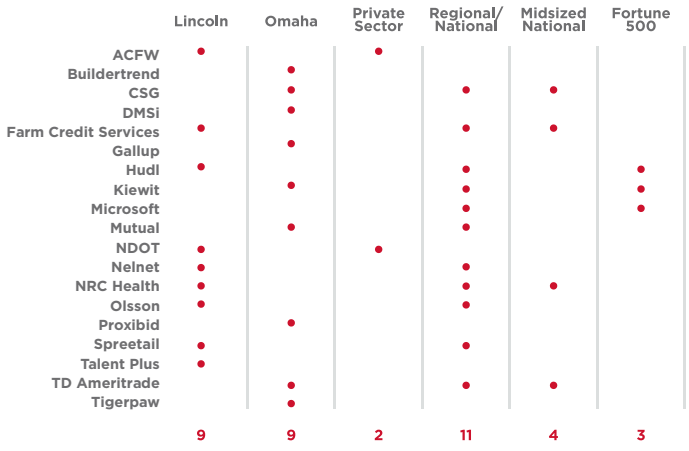


***Other:** Marketing, Electrical Engineering, Finance, Mechanical Engineering, Accounting, Management, Theatre*

Additional Majors and Minors

76	Mathematics
58	Business
21	Computer Science
6	Music Technology
6	Finance
5	Economics
4	Statistics
2	Leadership & Comm
2	History
1	Art
1	Computer Engineering
1	Digital Humanities
1	Management
1	Law & Business
1	Physics
1	Philosophy
1	Psychology
1	Robotics Engineering
1	Sexual Studies
1	Software Development
1	Spanish
1	Theatre Arts

Sponsor Market Sectors




DESIGN STUDIO
STUDENTS
& COACHES

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Ruben Aguilar
Keenan Allen
Mohamed Aly
Jack Arens
Kylie Becker
Conner Bell
Anthony Benes
Dipal Bhandari
Jayden Boesch
Luke Bogus
Emma Clausen
Grace Clausen
Spencer Collins
Joe Cowman
Alex Czarnick
Emily Dalton
Taylor DeMint
Grace Dickas
Sean Fitzgerald
Jared Fuelberth
Sam Futterman
Andre Garivay
Nathan Gentry
Dom Giandinoto
Jacob Gideon
Akshat Goel
Daniel Guo
Lucas Hall
Utkarsh Hardia
John Harkendorff
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Mark Nail
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Rohan Thakker
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Nguyen Huy Vuong
Ryan Wallace
Ryan Wolff
Megan Wright
Beibei Xiong
Christian Young
Adam Zastrow
Grace Zatorski
Andy Zhang
Dean Ziegelman

Design Studio Coaches

	Company	Project
Bill Anderson	Microsoft	Mutual of Omaha
Joel Brehm	Bolero Information Systems	Talent Plus
Todd Bryant	Todd Bryant Coaching	Hudl
Tom Deter	Assurity	Farm Credit Services of America
Nick Ebert	Spreetail	Kiewit
Yama Farani	TD Ameritrade	Proxibid
Jeff Hale	Agilx	Buildertrend
Jake Heidelk	Spreetail	Nebraska Department of Transportation
Nick Hershberger	Ameritas	Gallup
Michael Hollman	Hudl	CSG
Rob Nickolaus	Arbor Day Foundation	Microsoft
JR Noble	UNL - ITS	TD Ameritrade
Everett Rhodes	Don't Panic Labs	Tigerpaw
Chad Scribner	Firespring	Spreetail
Carl Steffen	Cornhusker Bank	DMSi
Leon Stewart	Fiserv	Olsson
Matt Will	Spreetail	Nelnet
Ella Wirtz		Academy for Child and Family Well Being
Brian Zimmer	Don't Panic Labs	NRC Health

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