

2020-
2021

RAIKES SCHOOL DESIGN STUDIO

Designing a brighter **future**



**DESIGN STUDIO
ANNUAL REPORT**

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Bringing Light



Mark Antonson
Director of Design Studio

A handwritten signature in black ink that reads "Mark Antonson". The signature is written in a cursive, flowing style.

A brighter future requires developing leaders today.

I'm not delivering news when I say that the last year has been universally tough for all of us. The global pandemic has affected every aspect of our lives, and Design Studio is no different in that regard. Like everyone, we spent last spring reacting to what was happening, and then spent the summer trying to get ahead and be proactive about this academic year. We've had to make major structural changes to how we operate, accommodating the variety of ways our students are tackling their work depending on their unique circumstances (in-person vs. remote, asynchronous vs. synchronous). We certainly embrace change, but usually not this much this fast – but there have been silver linings to this cloud.

This year we've seen the students adapt and thrive in a virtual or hybrid (some virtual, some face to face) working environment with their teams. I think many of us in the professional world are still coping with this change a year later, so seeing the students adapt so quickly and easily is truly impressive. Teams have found new ways to connect and work beyond what the staff and faculty ever would have thought of – and this is one of the many ways they continue to amaze us.

The students' ability to step up and lead their teams in this pandemic has also been inspiring. In a year marked with so much uncertainty and upheaval, we've all been looking to our leaders more than ever to help bring us to a brighter future.

In that regard, I'm more proud than ever of a program like Design Studio, helping the next generation of leaders to practice and hone those leadership skills before entering the workforce. There are no easy answers, but I'm confident our graduates are up to the challenge.

I also speak for the staff and faculty when I note how awed we are with the products delivered by the teams. While we're impressed every year, I think given the sum of challenges this year's teams faced, our sponsors are delighted with the work produced, and our students have a lot to look back on and be proud of. I hope you enjoy this glimpse into our future as you read through the rest of this year's annual report.

DESIGN STUDIO

Overview

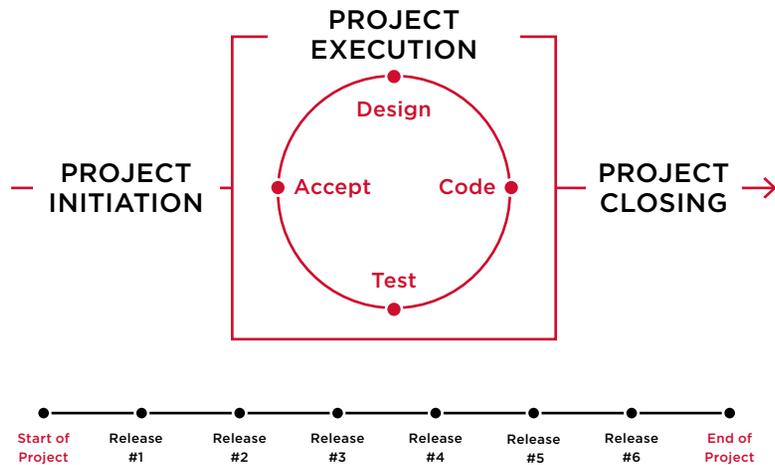
Design Studio uses a design-centered process for innovation to give University of Nebraska-Lincoln students studying at the intersection of business and engineering a highly interdisciplinary capstone experience. By engaging industry partners, we guide students in the development of innovative solutions 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 to 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 products to sponsors three times during each academic semester. Students learn first-hand how to leverage software to solve complex problems. They apply 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 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

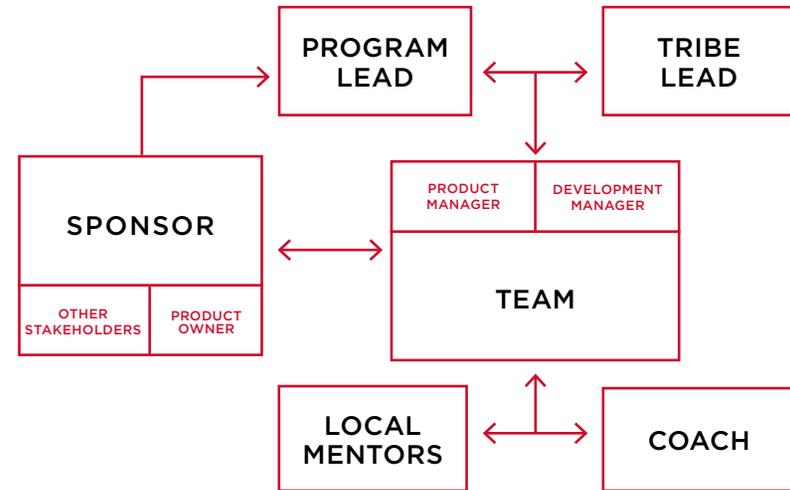
Objective: Produce and deliver value for sponsor through cumulative iterations.

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.

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 eight people can't possibly support 109 students in a program like Design Studio – it takes a village including our volunteer coaches, so flip to page 34 to see credit where credit is due.





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.



Dr. Justin Firestone
Assistant Professor of Practice, Tribe Lead

Focused on the intersection of technology, ethics, and law. Instructor for the second-year software engineering courses for the Raikes School and cyber law at the law school. Interested in promoting responsible technological innovations.



Marek Kracl
Assistant Director of Design Studio

Since completing Design Studio as an Associate, Marek worked as a Project Manager and key Software Engineer for a Lincoln startup. He brings broad industry knowledge to the student teams as well as recent-student insight to the faculty and staff.



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.



Cheryl Nelson
Design Studio Program Lead

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



Dr. Robert Mackalski
Assistant Professor of Practice, Tribe Lead

Software entrepreneur turned academic. Robert teaches the marketing courses at the Raikes School.



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.



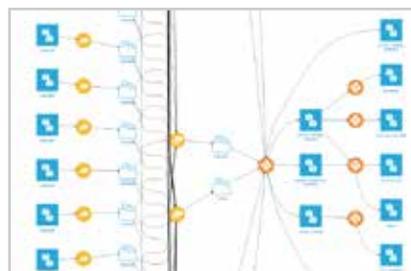
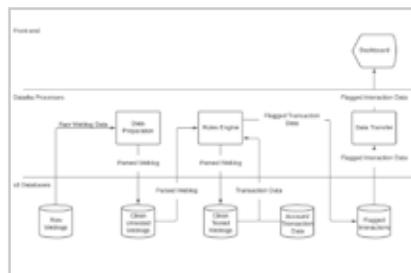
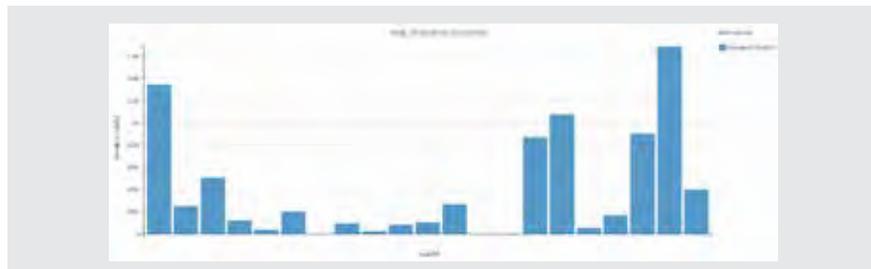
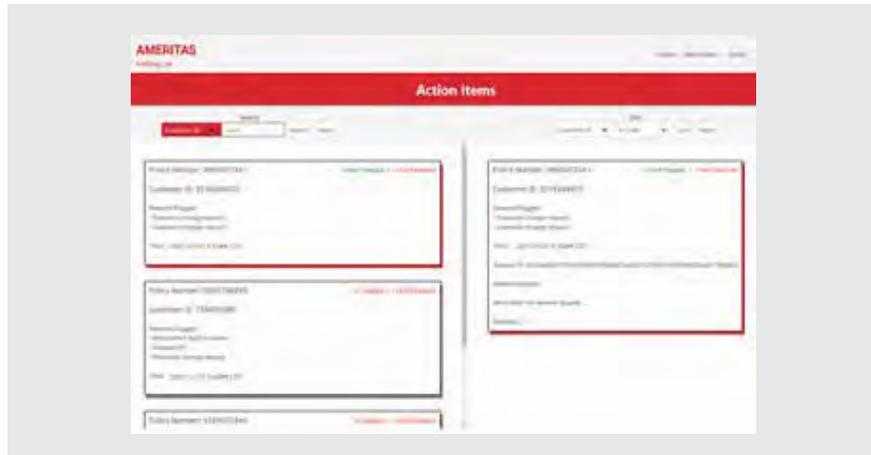
Dr. Stephanie Valentine
Assistant Professor of Practice, Tribe Lead

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

DESIGN STUDIO

Projects





Fraud Identification and Notification

Ameritas is a mutual-based insurance company that serves more than four million customers. Part of the Ameritas mission is to ensure the financial safety of their customers and help in protecting them against fraud. It is impossible to say how many instances of insurance fraud go undetected each year, but each occurrence is extremely costly, and the effect on the industry is significant.

The challenge was to create a foundational system to help Ameritas agents prevent fraud. The Design Studio team met with Ameritas call center agents to discuss fraud prevention strategies. The goal was to learn how to integrate with existing systems and determine where the team could provide the most value. Ultimately, the team came up with a solution that analyzes Ameritas

web activity and flags instances of potential fraud. After an interaction has been flagged, an Ameritas agent can investigate the situation and take steps to resolve the flag.

To achieve this goal, the team analyzed Ameritas historical data and derived a set of rules that are applied to new web data. More than 40,000 web interactions are run daily and evaluated for fraudulent data patterns and anomalies that would have otherwise gone undetected. Finally, the Design Studio team developed a dashboard to allow Ameritas agents to run the model and view flags. The system created by the Design Studio team will allow Ameritas to worry less about fraud and focus more on fulfilling the lives of their customers.

Student Team

Anna Holmquist
Caleb Ricketts
Anthony Bailous

Jacob Mann
Max Nguyen

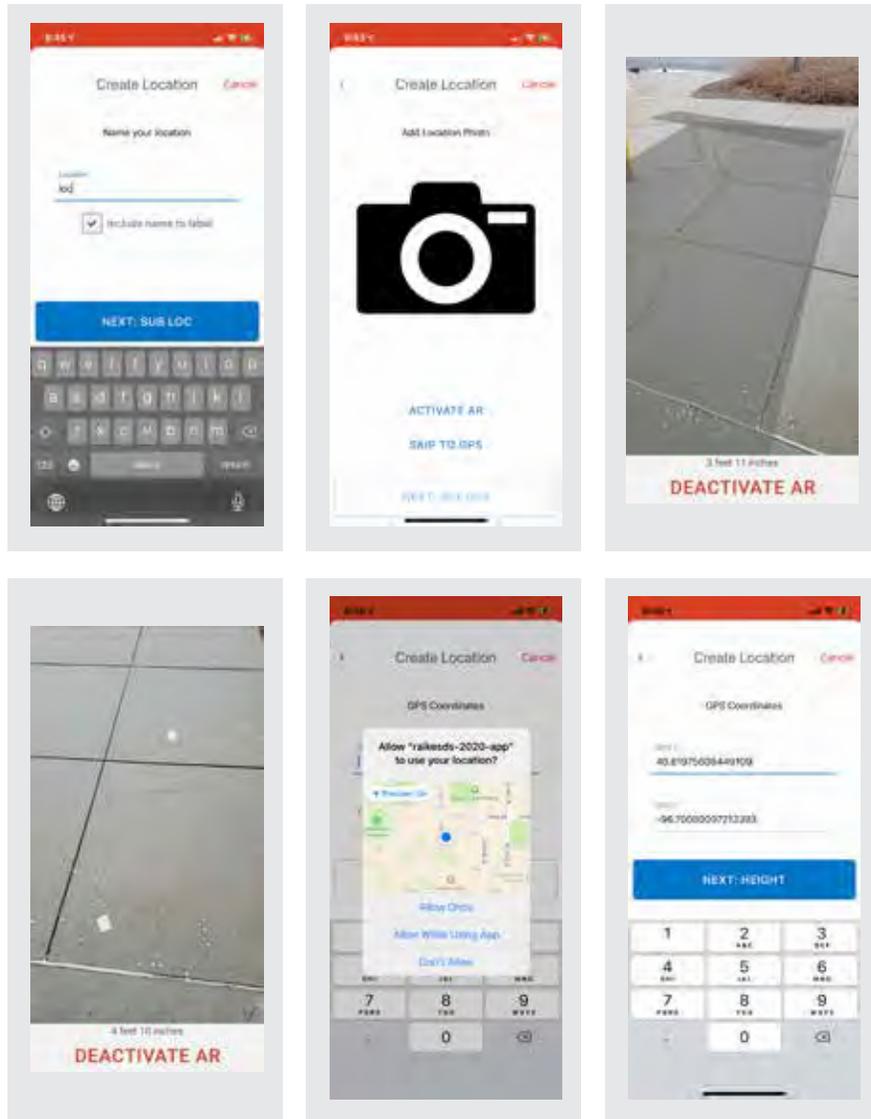


Simplifying Warehouse Organization

For decades, warehouses have relied heavily on paper systems for their warehouse management systems (WMS). Unfortunately, paper systems are not as scalable, nor as reliable as paperless alternatives. DMSi has begun resolving this issue by first creating Agility, an Enterprise Resource Planning software package, to help warehouse managers set up their locations digitally. However, due to the sheer size of warehouses, a more mobile solution is needed to create these locations on the fly, as warehouse employees move between locations/regions within a warehouse.

To help onboard these warehouses more seamlessly into DMSi's existing, full WMS solution, the team created an accessible mobile application utilizing augmented reality to create locations within a

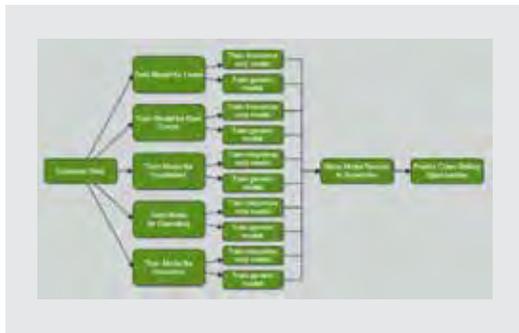
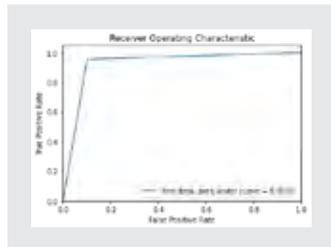
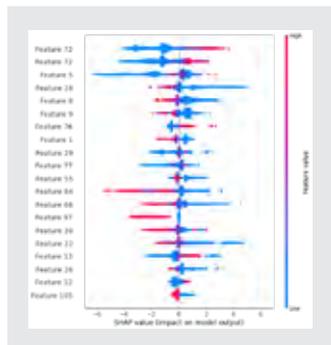
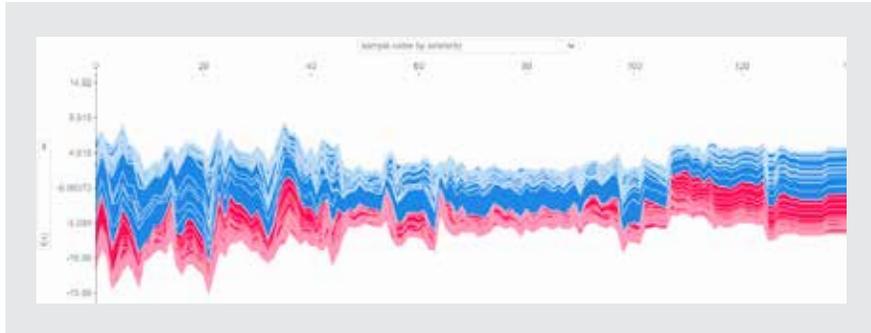
warehouse efficiently. This application creates a streamlined location setup/creation process for warehouse managers, saving them both time and money. This service automates some of the onboarding steps by using geolocation for pinpointing exact GPS coordinates (longitude/latitude) and AR for detecting location sizes (height/width/depth). Furthermore, the application provides the foundation for generating a 2D map of the warehouse, which leads to opportunities in improving supply chain management through analysis of optimal warehouse layouts. Ultimately, this tool serves as one of the largest missing puzzle pieces in DMSi's goal in creating a holistic WMS for its customers.



Student Team

Jarod Aerts
Nick Nguyen
Bryan Chavez

Antonio Linhart
Trey Turner



Cross-Product Penetration

The goal of the FCSAmerica Cross-Product Penetration project was to use machine learning and data science techniques to build predictive models that aid in identifying current customers that are likely to be interested in acquiring a new product or obtaining more of a product. The algorithm uses a variety of machine learning techniques to analyze multiple factors for each customer to determine their likelihood of obtaining more of a product in each of the FCSAmerica product domains within the year.

When developing this model, the team had to balance creating a highly performant model with building a model that was interpretable and provided evidence supporting the prediction. These two factors were essential to ensure that the sales team could trust the results and understand what specifically led to the prediction that a potential customer is an ideal candidate for a cross-sales attempt. To achieve this goal, the team used both logistic regression and extreme gradient boosting with Shapley additive explanations.

Student Team

Austin Collins
 Luke Van Drie
 Keenan Allen

Hundter Biede
 Jimmy Erickson



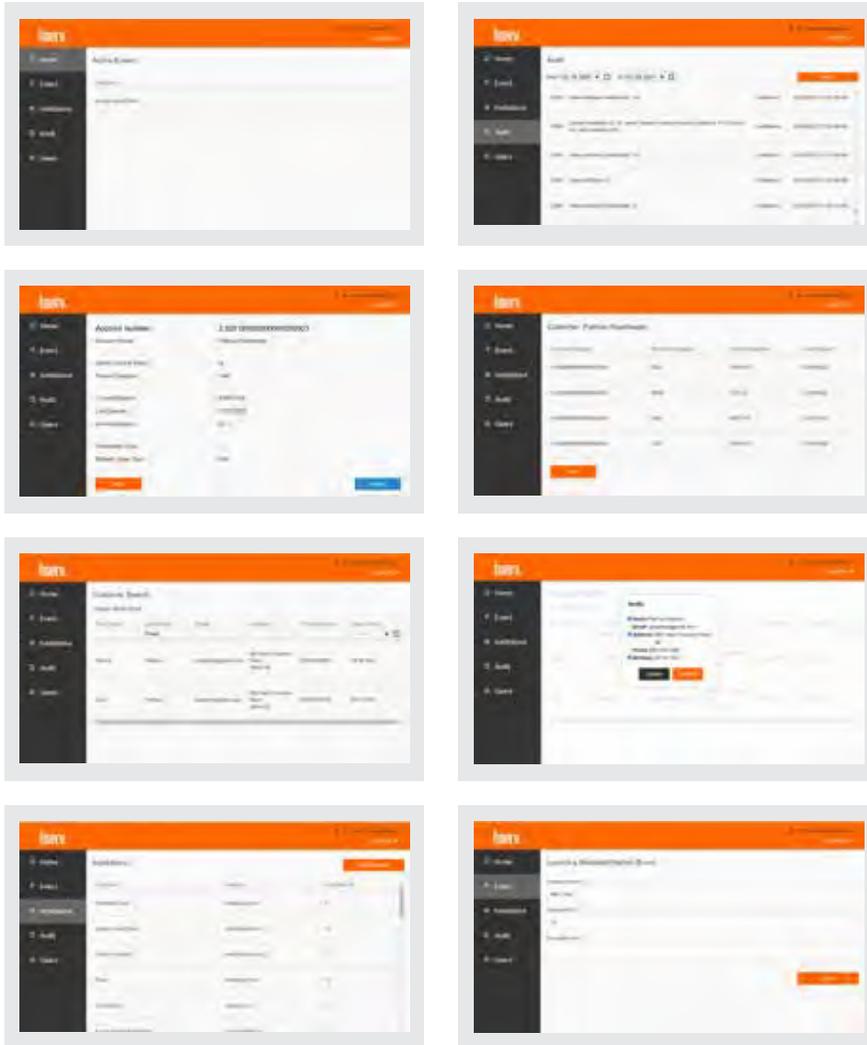
Sheltered Harbor Account Restoration Platform

Cyber threats are exploding: in March 2020 ransomware attacks rose 148%. Individual financial institutions (banks and credit unions) cannot prevent all attacks. Yet in today's connected world, a paralyzing attack on even one financial institution that prevents consumers from accessing their accounts could start panic across the whole financial services industry. So what's the answer? A plan. One such plan is called Sheltered Harbor.

Sheltered Harbor is a not-for-profit organization with a directive to create and promote process standards and fail-safe backup procedures across the financial industry. Their end goal is protecting consumers, financial institutions, and public confidence in the financial system in the event of cyber-attack or other worst-case scenarios. Fiserv, a multi-national company

that provides financial services to banks and credit unions, has partnered with the Sheltered Harbor to provide intermediary services to financial institutions.

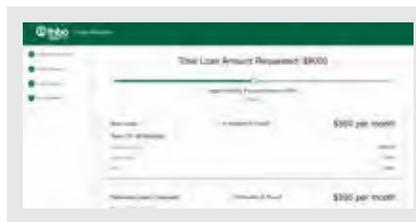
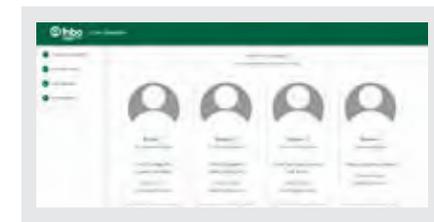
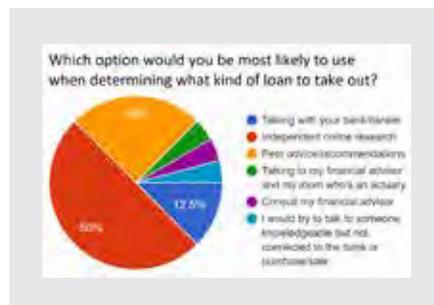
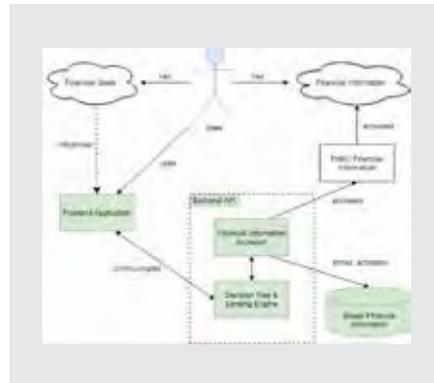
The Fiserv Design Studio team collaborated with Fiserv to develop a holistic solution to intake, decrypt, restore, and query financial institution data backups. This project provides financial institutions: (1) the ability to automate and securely vault critical customer data; (2) the ability to retrieve a specific date of vaulted information; (3) the ability to restore the secured database to a certified Sheltered Harbor service provider environment; (4) the ability to retrieve specific customer information and account balances, allowing daily client interactions to take place with limited impact.



Student Team

Lara Quiring
Allie Rauner
Jayson Cheng

Zach Kerkman
Amanda Rowley



Lending Advice Engine

Customers rely on FNBO for meaningful, personalized guidance to help them take and maintain control of their finances. Currently, customers researching potential purchases and financing could look to in-branch bankers to receive guidance in different forms based on the banker's preferences. At times, those preferences may not consider the entire range of available options or the individual's holistic financial situation. Customers can benefit from the opportunity to understand their options and make financial decisions that align with their personal circumstances.

The team created a decision tree for the lending advice engine. By meeting with bankers, the team learned the circumstances different bankers would advise specific options. The team captured FNBO's strategy to determine loans the customer will likely qualify for and their credit card options.

The solution takes the customer's reason for the loan, current financial situation, preferred loan length and payment, and potential collateral options to output several of the best options available at FNBO the customer may qualify for, including unsecured personal loans, loans secured with a car or home, or promotional credit card periods. The customer is then encouraged to contact a banker to discuss these options further and can provide a summary page to the banker for ease in communication.

The team also focused on creating a web application that was intuitive and accessible. The user completes a short survey with explanations of any financial terms and is directed to the loan recommendation page that shows the types of loans with rates, term lengths, and overall amount paid on each loan option. Through this application, the customer can research their options on their own time and come to FNBO bankers with a better understanding, greater trust, and a built-in relationship with FNBO.

Student Team

Maria Maxon
Emma Kate Stapp
David Besonen

Stan Drvol
John Earnest



Heyday Mobile App

Heyday is a startup founded by two Raikes School Seniors aimed at helping Gen Z better plan and manage their finances. The Heyday Design Studio team, led by the student founders of Heyday, was challenged to build the Heyday cross-platform mobile application.

As the sole Design Studio student startup team, Heyday team members had a unique opportunity to define their own project, pivot frequently along the way, and ultimately ship a powerful mobile application currently helping young people around the country make more educated financial decisions.

Young people try to “plan ahead” financially by setting rough goals for how many hours to work each week, how much to spend on food, clothing, etc., and how much to be setting aside in case the uncertainty of their situation catches up to them. Unfortunately,

it often does. The Heyday mobile app, developed by the Heyday Design Studio team, solves this problem by giving Gen Z visibility into their financial future using an accessible and understandable cash-flow projection.

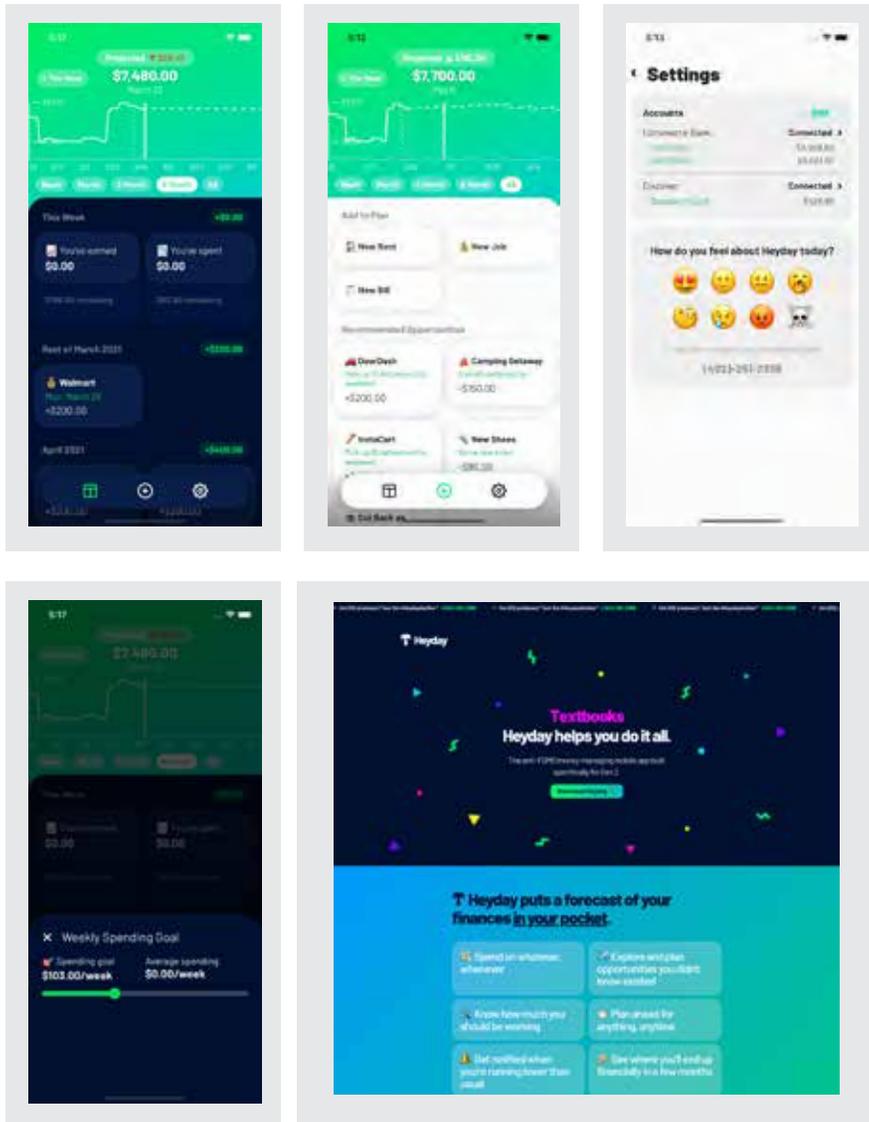
Despite its many pivots along the way, the Heyday team is proud of the beautiful cross-platform mobile application, powered by a robust backend API responsible for interpreting tens of thousands of financial transactions, that it built over the past year of Design Studio.

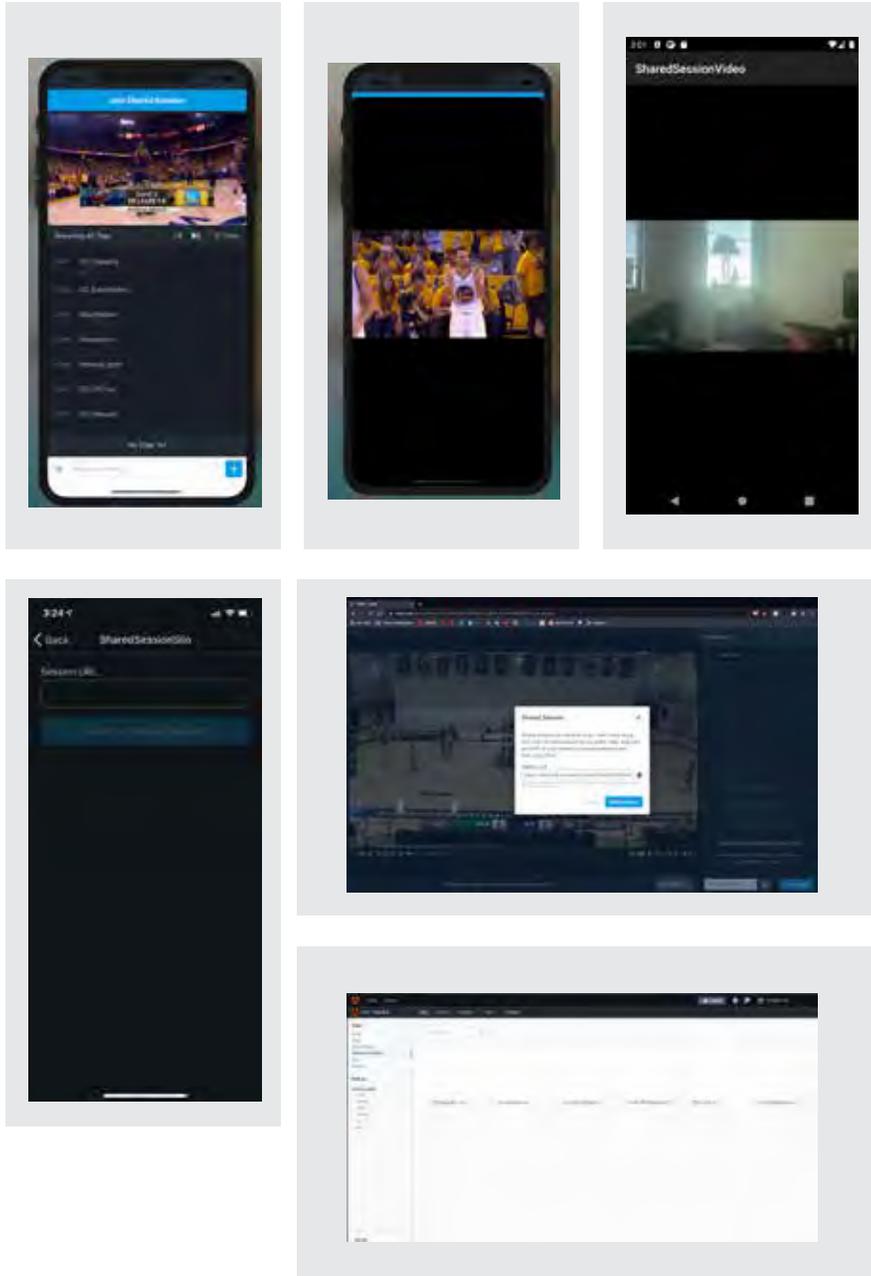
The team looks forward to continuing to work on Heyday post-DS with the goal of delivering on its mission to help Gen Z make optimal financial decisions. Visit <https://heyday.money> for more information!

Student Team

Jacob Gideon
 Nick Siscoe
 Thomas Kennedy
 Robert Kirkpatrick

Tanner Nash
 Josh Thiele
 Luke Farritor





Training and Collaboration Tools

Hudl has been a leading sports analytics company since its inception with its emphasis on using video of games and practices as a strong tool in an analytics toolkit. However, as the world ground to a halt due to the COVID-19 pandemic, societal changes took place that disrupted the world of sports and created challenges for practices and in-person coaching over team video footage. To address these challenges, Hudl tasked Design Studio to discover ways to reorganize their video landing page to make it more conducive towards training videos, and to implement a tool within the existing Hudl platform that would allow coaches and athletes seamless video collaboration capabilities.

To create these two main features, the team began by interviewing coaches on what features would solve many of those issues. After these interviews, the team went to the drawing board and created many mockups

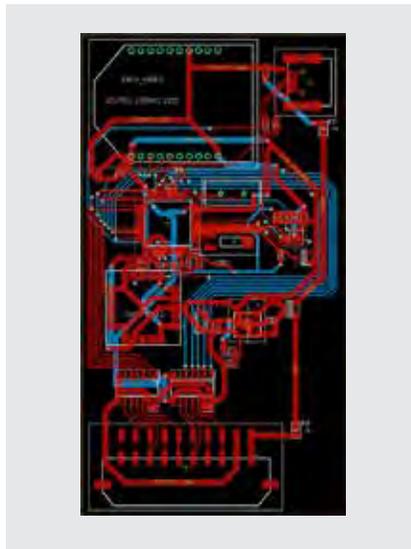
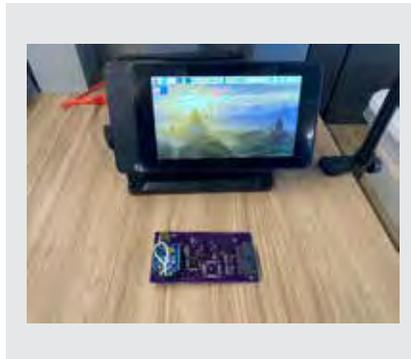
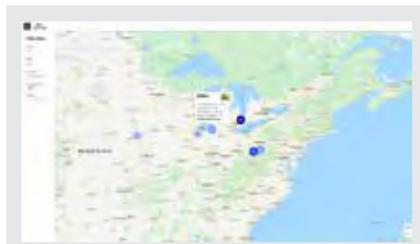
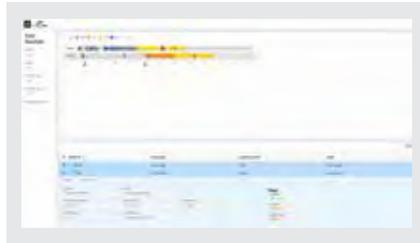
and interviewed coaches on the elements they liked about each mockup. Afterwards the team transitioned into a new feature that created synchronous video sharing capabilities between coaches and their athletes where both coaches and athletes could watch the same video simultaneously with the coach having the capability to control all aspects of video playback (play, pause, seek, etc.) so that coaches and athletes can collaborate simultaneously on mobile platforms.

The team was able to successfully implement these features within Hudl's mobile suite (both on Android and iOS devices). Using this feature, coaches can easily communicate with their athletes and provide pointers to them virtually and in real time which will be another useful tool in Hudl's ability to provide value to Training and Collaboration.

Student Team

Ian Anderson
Sheng-Jie Lim
Landon Borges

Cole McReynolds
Ben Stuart



Advanced Welding Analytics

Kiewit has construction sites all over the globe. At these sites, site managers need to ensure quality welds are occurring, but due to the time and cost of this, not all welds can be evaluated. Kiewit plans to take the information generated from each weld and be able to display useful metrics and eventually run machine learning on the data in order to determine the quality of each weld. This will enable welding managers to more efficiently evaluate welds, and be able to spend less time doing so with this hands-off approach.

The Kiewit team assisted this process in two key ways. First, they ensured the data the welding machines are generating is picked up and stored in a database. They did so by redesigning hardware boards to be placed in the welding machines to gather and send the data to a central node at the construction site, comprised of a Raspberry Pi, which

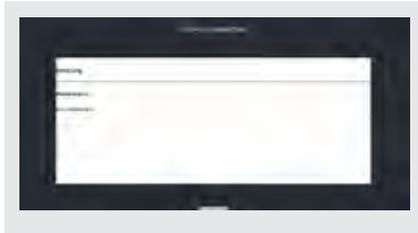
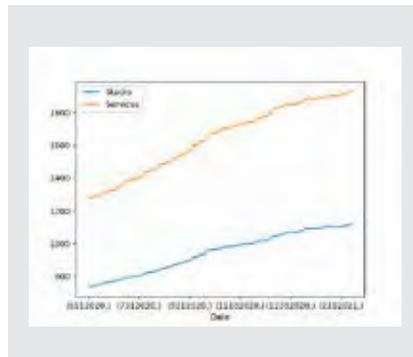
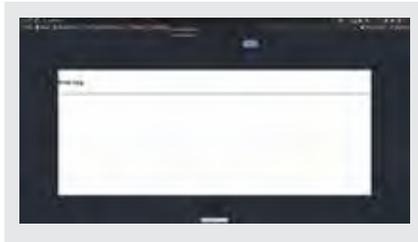
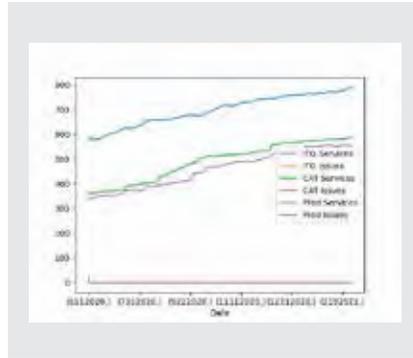
would then send the welding data to the backend to be processed and parsed into useful information, and then stored in the database.

The second way the team assisted Kiewit in their plans was by creating an intuitive user interface to display critical analytics of all the welds at a construction site. They interviewed welding managers to find what data was most important for them and displayed it by creating a web application, displaying weld information and graphing welding modes and Blue Light Time over time.

Student Team

Sierra Futterman
 Andrew Phares
 Anthony Benes

Ryan Lampe
 Patrick Murphy
 Max Radlicz



The Kubernetes Project

The goal of this project was building out a system that would streamline the process of migration from Docker to Kubernetes. It was crucial to streamline this process given how many files Mutual of Omaha is responsible for. The migration to Kubernetes would be a cost-effective transition given the large current expense of using Docker.

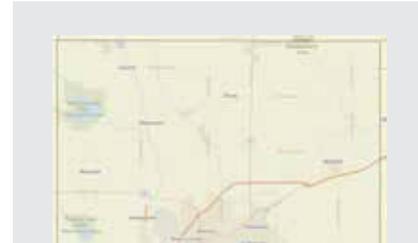
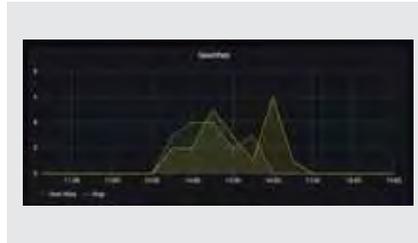
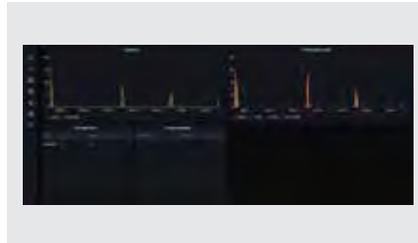
The Design Studio team aided in this migration by building a tool that automates the process of creating a Values file from a Docker Stack file. The user is now able to upload any Docker Stack file and nearly instantaneously receive the corresponding Value file. This process now requires no interaction with the command line or any other low-level processes. Instead, this complex backend task is all obscured and the user is able to focus only on the frontend system. The process of converting a Docker

Stack file over was also streamlined due to the robust error handling system of the application. In the case that the user forgot to include fields that were necessary for the translation, the application warns users of the specific reason for the translation failure. This greatly speeds up the translation process given the sheer number of files that will need to be translated to Kubernetes.

Beyond simply developing a tool that would aid in the translation, the Design Studio team also developed extensive documentation surrounding the tool. There is a detailed startup guide that includes example translations and step by step instructions for how to use the tool. This is crucial given the specific domain knowledge that would otherwise make a Docker to Kubernetes translation challenging.

Student Team

- | | |
|----------------------------|-------------------------|
| Christopher Burbach | Katie Leger |
| Emma Clausen | Chris Wieskamp |
| Tommy Braccia | Shivani Mudhelli |



Nebraska Transportation Information Portal Phase #4

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 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 or 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. The heatmap, which calculates heat based purely off of the number of crashes on a roadway, is misleading. Analysts must spend their time combating these issues, which directly

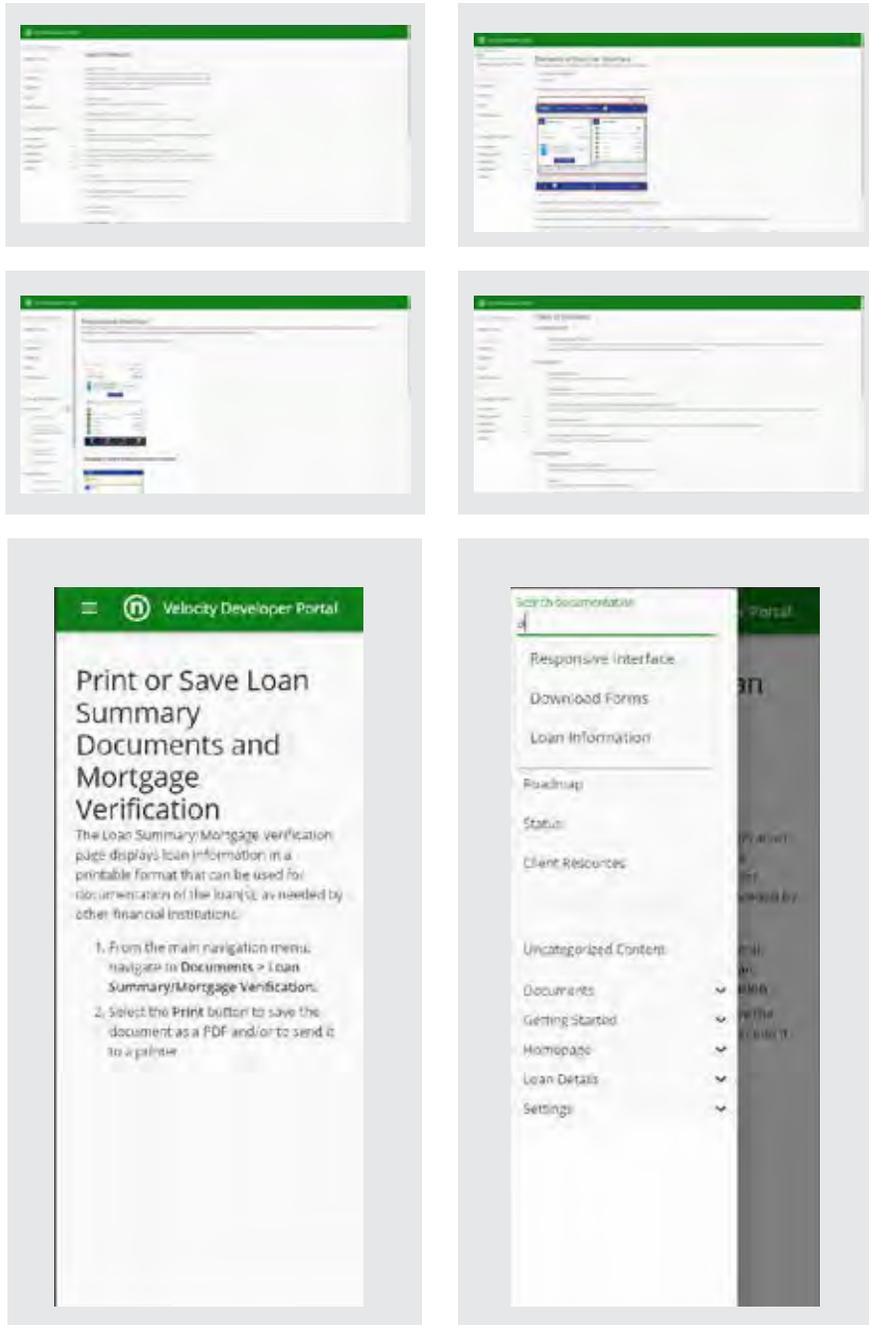
trades off with how much time and effort they can focus on adding important insights.

Phase #4 of this project refines NTIP by adding new tools and automating processes for analysts to take advantage of. The Design Studio team created new filters for users, updated the database schema to follow the modern industry standard, and updated the heatmap algorithm to better reflect heat values representing crash density. The team also developed a Web Analytics Dashboard that allows the Nebraska Department of Transportation to view analytics surrounding the NTIP application. The sponsor can now easily view detailed search information and user statistics such as common user actions, user location data, etc. These changes help accelerate the NTIP application by staying up-to-date with the modern crash criteria format, and providing key application insights about its users.

Student Team

Erica Mays
Parker Segal
Uri Herszbaum-Harding

Kassidy Maher
Danny Tran



Developer Portal

Nelnet, Inc., headquartered in Lincoln, Nebraska, is a diverse company with a focus on delivering education-related products and services and student loan asset management. The Nelnet Velocity team exists within Consumer Services, a division of Nelnet Diversified Services. Velocity is a microservices-architected, API-first, cloud-native and asset-class-agnostic platform designed to be robust, scalable, resilient, secure, flexible and client/customer-experience focused.

Originally, the Nelnet Velocity team needed a single place to store API reference documentation and other technical documentation found within their repositories, a Swagger site, and an MVP client-facing site. The downside of this current system was that documentation was not housed in a single location, technical writers could not update the Swagger site or internal repositories, and there was no way to store additional content types (marketing materials, getting started guides, etc.). The team began working on a searchable, easily navigable fully featured documentation

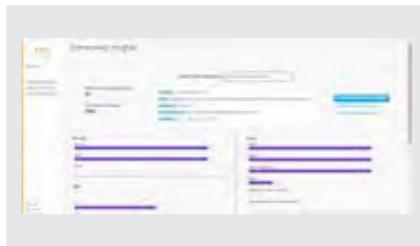
portal with the purpose of housing and displaying API reference documentation and more general documentation about the Nelnet Velocity platform and microservices.

The team began goals of leveraging Prismic, a content management system, to house and display markdown files containing documentation. Prismic allowed for multiple types of media including photos and charts to be displayed alongside text. The team leveraged GraphQL to automatically pull in new content from Velocity repositories. The team leveraged Rehype React to add syntax highlighting to the code excerpts in the documentation. Based on a change in sponsor needs, the team pivoted to create a site to house specifically pre-authored content (marketing) for internal and external clients of the Nelnet Velocity services team. From then, the team pivoted to solely focusing on using the content management system to create a well-organized and user-friendly documentation portal. The site is intuitive and easy to use for content authors, internal content consumers, and external clients.

Student Team

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Nick Burbach

Laura Derowitsch
Brady Klein
Sifat Syed



Community Insights

NRC Health partners with 26 out of the top 30 healthcare systems in the country and over 9,000 total healthcare organizations. Feedback from over 25 million annual consumer voices power the NRC Health Customer Intelligence Platform. For the past 35 years the NRC Health suite of products have helped healthcare organizations illuminate and improve the moments that matter to patients, residents, physicians, nurses, and staff.

Traditionally, healthcare systems are not known as nimble organizations. Technology and process changes don't often come easily or rapidly. With the rise of technology-driven healthcare and the rise of healthcare consumerism, healthcare systems are increasingly overwhelmed by a high number of consumer, patient, and employee information systems. Managing and consolidating these information sources can become a costly endeavor and operationalizing new processes can be burdensome only to receive a negligible amount of value as a result of their effort.

Community Insights aims to make it more efficient for health systems to forge partnerships with an engaged digital community to test new innovations, strategies, and processes.

The Community Insights Dashboard that we have built enables NRC's customers to quickly group their consumers and patients into targeted communities, relieving the significant time strain often necessary to find and gather information for the appropriate participants for particular studies of organizational performance and consumer satisfaction evaluation. From the dashboard, users are given the capabilities to launch pre-configured studies to individual segments and to access the results and findings of past studies, ultimately enabling healthcare systems to begin researching strategies, testing hypothetical processes, and soliciting consumer feedback in a fraction of the time previously required.

Student Team

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Lilly Moore
Ryan Wolff
Clare Kramper



Building Use Efficiency Platform

With the rise of hybrid workforces, people are shifting the way they interact with the built environment. Accelerated by COVID-19, businesses are feeling the pressure to adjust given the rising costs of office ownership and leasing. With the ever-changing space utilization requirements by companies and employees alike, businesses need data-driven insights to answer the questions: How do their employees use their current space? How can they lower utility costs? How can they optimize their future floor plans and remodeling projects?

Introducing the Olsson Building Use Efficiency Platform, a custom sensor and web application platform that provides an end-to-end experience for building engineers and building science specialists to collect, analyze, and visualize data of building and office spaces. With data collection of environmental factors such as temperature, humidity, lux, UV, and

occupancy (motion), this custom product enables Olsson to create a new product line that empowers clients with data-driven recommendations for future remodeling, building, and engineering projects with Olsson.

The team developed a custom hardware solution based on the Z-Wave wireless protocol using two different components: 1) Off-the-shelf environmental sensors to enable the on-site installation of data-collecting sensors and 2) Raspberry Pi single-board computers to coordinate sensor configuration, data collection, and data uploading. This data is sent to a custom web application—compatible on desktop, tablet, and mobile—to enable the provisioning and pairing of sensors and hubs, filtering and sorting of sensor data, visualizing desired data via a robust charting experience, and exporting data as a CSV file for further exploration.

Student Team

Luke Bogus
Matt Vavricek
Rachel Nordgren

Brian Reynolds
Shreeya Vaitla



Cloud Framework Manager and Notification System

First semester, the team was tasked to create an interface that would make importing and managing OpsCompass cloud frameworks more efficient. Frameworks are complex structures with many interrelated parts that define sets of cloud security standards that can be tracked using the OpsCompass platform. Before this year, developers were manually writing code to support each new framework added to the platform. This new product will automate the process, allowing developers to meet the customers' need for new frameworks, and eventually allow customers to create and manage their own frameworks.

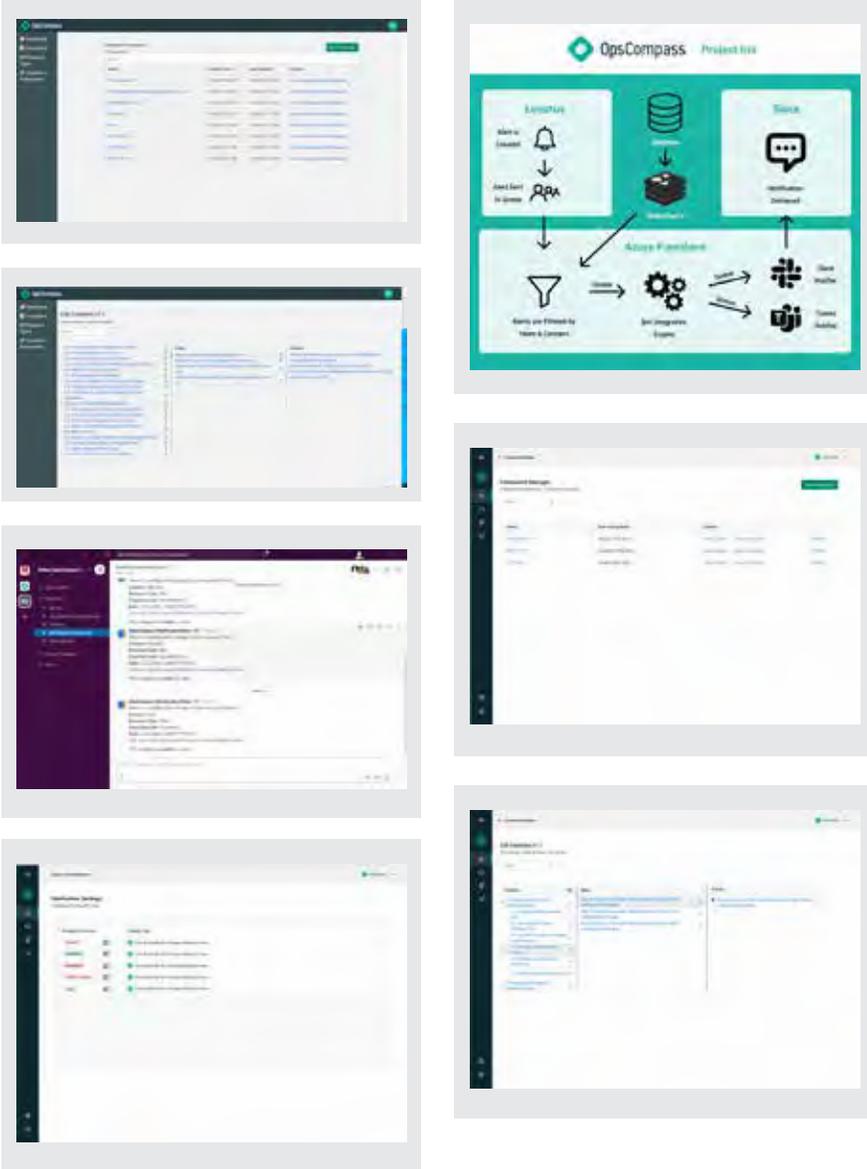
OpsCompass decided they needed this system more urgently than originally expected, so after the first semester was over, OpsCompass developers took over the project to work on it full time over the two month winter break.

At the start of second semester, the team was challenged to create a customizable system to notify users about drift, or changes in their cloud accounts, through the messaging platform, Slack. This would allow users to easily stay up to date on their cloud systems and monitor drift events that are important to them, while also driving users to the OpsCompass dashboard and helping to make using OpsCompass a greater part of their cloud security routine. This integration was developed with extensibility in mind, so that integrations with additional messaging platforms can be easily added in the future.

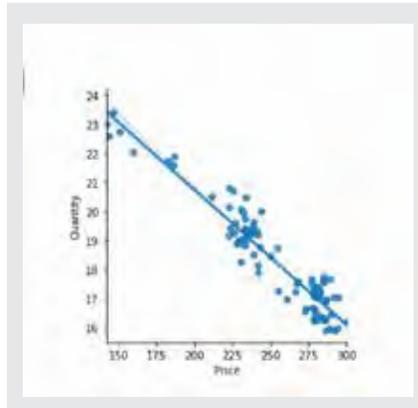
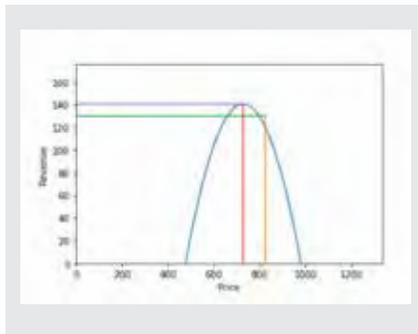
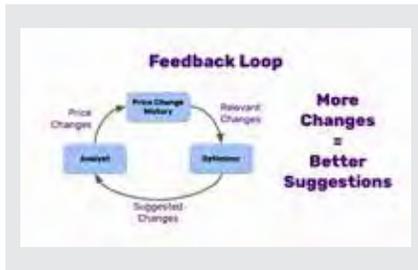
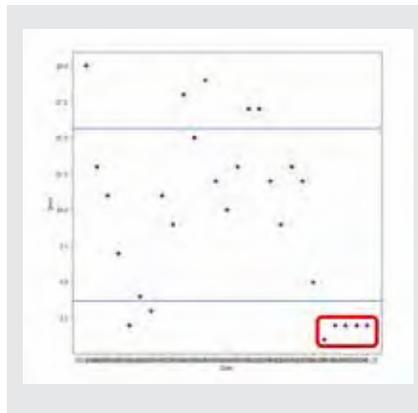
Student Team

Aayush Khatiwada
Megan Wright
Daryn Capps

Tom Hermanek
Michael Kovar
Bennett Wright



Buy Number	Current Price	Recommended Price	Profit Margin	Quantity Sold
100004	\$1.75	\$1.50	\$1.43	100
100007	\$1.50	\$1.50	\$1.14	100
100001	\$2.00	\$2.00	\$2.18	100
100019	\$1.00	\$1.00	\$1.14	100
100008	\$2.00	\$2.00	\$2.25	100
100005	\$1.14	\$1.14	\$1.14	100
100018	\$2.00	\$2.00	\$2.00	1000
100003	\$1.00	\$1.00	\$1.14	100



Product Repricing & Analysis

Speedway Motors is the oldest speed shop in the United States. They are also one of the largest, helping thousands of car enthusiasts, racers, and gearheads create meaningful experiences they'll remember forever. They operate a modern e-commerce business fulfilling over a million orders per year across several channels with a catalog of thousands of different products ranging from engine parts to tires. A critical piece of this business is pricing; any sub-optimal product price will result in either fewer sales or worse profitability. Their current pricing approach is highly manual and doesn't allow them to analyze prices frequently and at scale. They proposed the creation of an intelligent pricing application that would enable them to improve profitability at scale.

The team created a smart pricing pipeline that integrates with Speedway's sales data and identifies opportunities to

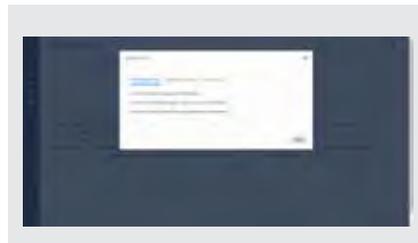
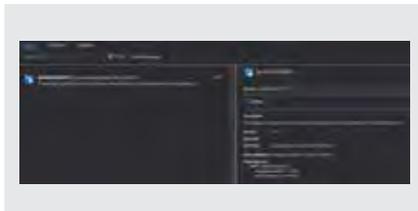
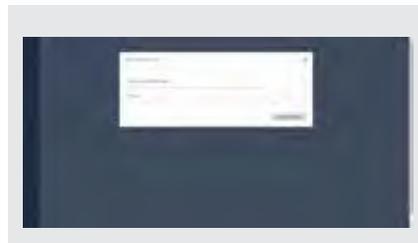
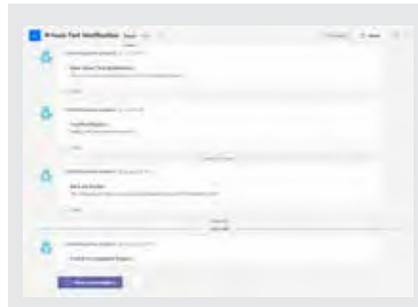
improve profitability. The program ingests information about product SKUs and their sales performance, then uses this information to detect specific types of events that warrant a price change. The team worked closely with Speedway analysts to identify these scenarios, including sales deviation, product depreciation, and cost increase. The program then recommends a new price using what it knows about the product's demand and cost structure.

The program generates hundreds of these recommendations weekly and displays them on a dashboard where a human analyst can decide whether or not to implement them. When a change is implemented, the program tracks its performance and estimates its impact. So far, the system has seen strong results, with a positive effect on profit across hundreds of implemented price changes.

Student Team

Dom Giandinoto
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Caitlin McCarthy
Jessica Chen



Project Notify

Spreetail is a rapidly growing e-commerce company whose primary business involves selling through marketplace partners like Amazon, eBay, and Walmart. As Spreetail grows, its goal is to be the best partner possible with the many vendors and channels it works with. Technology will allow Spreetail to communicate information, needs, and action quickly and efficiently. To use technology to drive work, Spreetail needs the ability to push information to its users internally and partners externally. The Design Studio team was tasked with engineering the systems and designing the interfaces required to notify users of events throughout the system. This included the delivery of reusable software libraries and interfaces to enable engineers to create, deliver, and react to notification events. Essentially, the team was asked to build an enterprise-wide notification system from scratch.

The team first conducted interviews with Spreetail employees to discover their problems with existing notification systems. The team also performed technical research

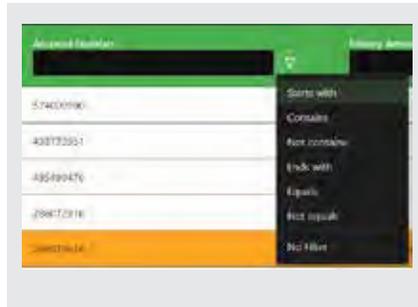
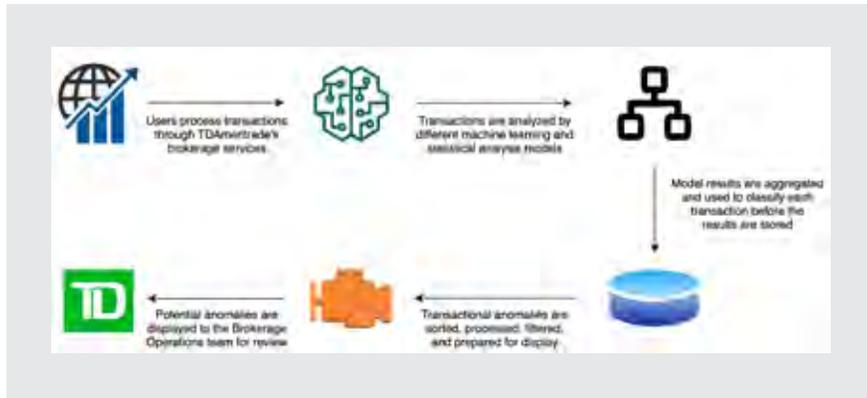
to determine the best and most efficient technologies to use for development. After constructing a vision for the notification platform, the team pitched its idea to Spreetail executives and got approval to move forward.

The team then created a set of reusable functions that Spreetail engineers can implement into their own programs. For example, an engineer could use the platform to quickly code a program that automatically notifies purchasing managers when an item is out of stock online. The team also created a website interface for the platform where Spreetail employees can view their notifications. That interface is stored on Spreetail's internal network of apps, allowing employees to access their notifications in a familiar place. The platform also enables notification delivery via Microsoft Teams. The team completed its objectives and Spreetail can communicate quicker and more efficiently as a result.

Student Team

Connor Jolley
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 Navya Singh
 Emma Mirnics



Back Office Transaction Monitoring

TD Ameritrade's Brokerage Operations processes millions of transactions every day in support of clearing stock trades and settling client balances. While processing all of these transactions, it is inevitable that there will occur errors and anomalies in the data. These anomalies could happen from typographical errors, duplicate transaction processing, or calculation and rule errors. In the past, TD Ameritrade relied on controls, oversight reports, and monitoring groups to detect anomalies in their data and react accordingly, however these systems often relied on the obviousness of errors in transactional data, or the ability of manual review.

The object of this project was to develop a monitoring system that can detect data anomalies within transactions as close as possible to when they occur. This system had to process millions of records in a day, using some form of machine learning

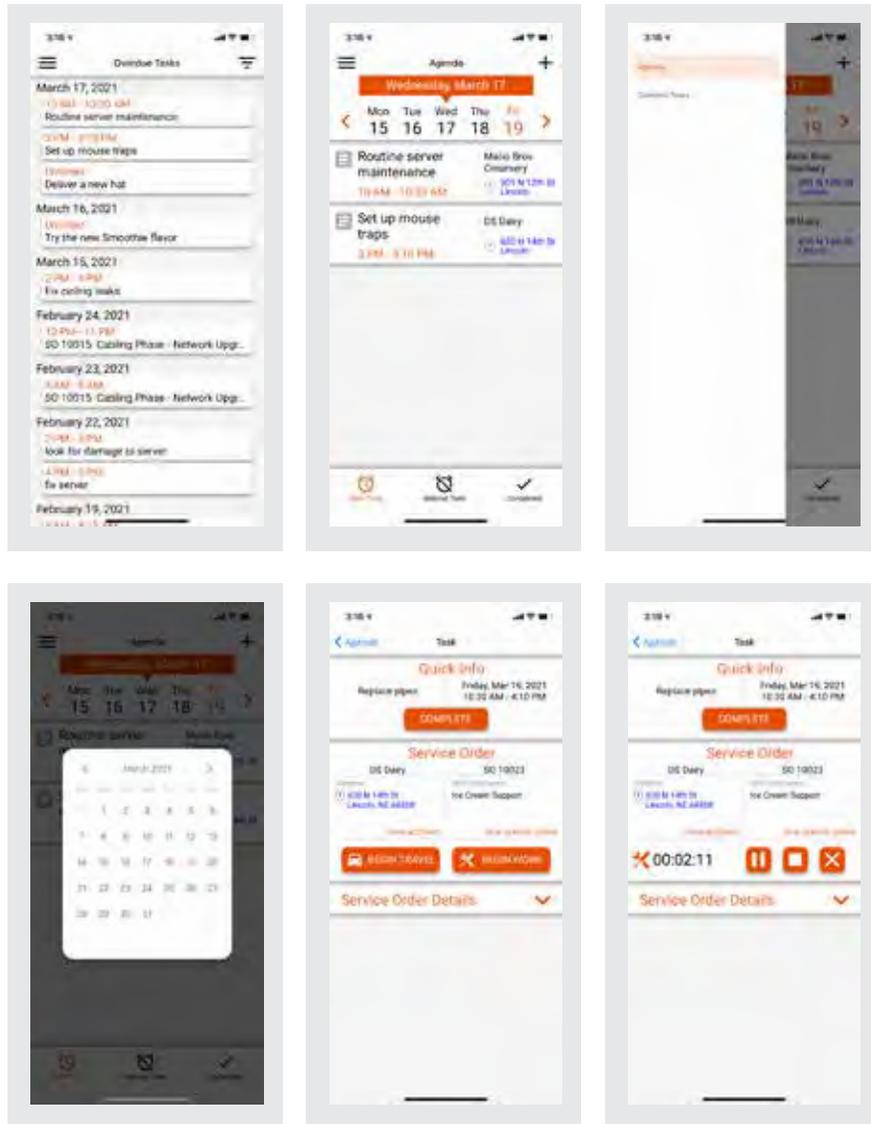
or statistical analysis, and was intended to enable TD Ameritrade to identify the anomalies and react accordingly. These guidelines served as the basis for the team's software solution for TD Ameritrade's Brokerage Operations.

The team's solution polls live transaction data hourly, cleaning and transforming the transactions before passing it into their machine learning system. There, the data is run through multiple machine learning and statistical analysis models, before being aggregated into a final binary labelling for anomalies. Those labelled transactions are stored for future reference in TD Ameritrade's systems, and then used to populate a web application for end users to view. This enables TD Ameritrade's teams to see suspected anomalies, and then review those flagged transactions further, rather than attempting to review the millions of daily transactions.

Student Team

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Mobile App Remake

The Tigerpaw team was tasked with upgrading Tigerpaw’s existing app. Tigerpaw is a company that provides software to technicians that travel to homes or businesses to complete work. This app provides a schedule of daily tasks for these technicians, and when they click upon these tasks, they can see addresses and instructions for the requested service. Technicians can also use the app to record their work accomplished, and the app takes their time logs automatically. Tigerpaw’s project requested an app upgrade with a focus on UI and location tracking.

The team completely made over the user interface. They did this by creating a brand new app with functionality modeled after Tigerpaw’s existing app. They decided the design should be as user-centric as possible, so they hosted a few interviews with users and sent out a survey. These interviews and surveys contained questions about how technicians were using the old app. It also asked them to discuss their likes and dislikes. Ultimately, the Tigerpaw

team could point back to survey answers or interview answers as the impetus for all the UI redesign decisions. The team provided Tigerpaw with an updated UI that reflects the app’s contemporary nature and provided an intuitive workflow that helps technicians use the app more effectively and conveniently.

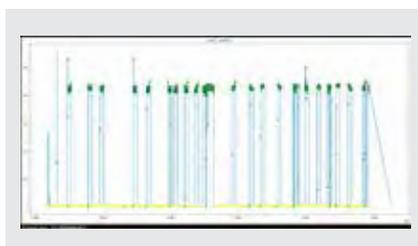
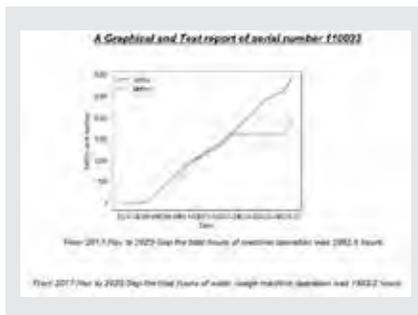
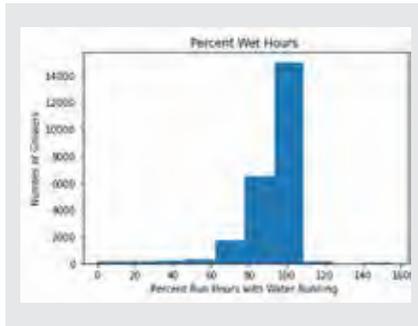
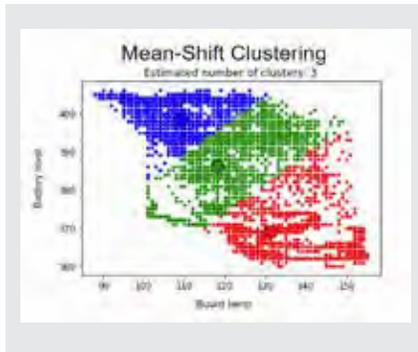
In addition to the UI redesign, the team also added location-based features that do not exist in the old app. The app periodically records the location of technicians while they are logged into the app. This feature has two main benefits: location verification while onsite and arrival estimation when traveling to a work site. Tigerpaw’s customers appreciate having this location information because they can point to it if their clients ever call into question the hours a technician is billing. Clients of the technicians appreciate this functionality because they can receive text messages that inform them when a technician is 5 minutes away, arrives on site, leaves, or anything else Tigerpaw wants to add in the future.

Student Team

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Robyn MacDonald



Irrigation IoT Analytics

When an irrigation pivot experiences a breakdown, normal day to day growing operations can be ground to a halt. A grower's irrigation is put on hold until a dealer can send out a team to troubleshoot and replace parts. A \$6 dollar battery failure can cause a \$30,000 center pivot to malfunction. If growers and dealers were aware of issues beforehand, they would be able to proactively work to mitigate potential problems before a breakdown occurs.

Valmont Industries has more than 100,000 connected devices related to irrigation management and center pivot monitoring. Stored in the data is key telemetry related to machine operations, device health, and water management. The Design Studio team worked to create machine learning models to report on, troubleshoot, and predict breakdowns due to various causes. The team

interviewed growers, dealers, and Valmont representatives to identify critical problem areas such as battery malfunctions, pivots getting stuck, and sudden losses in water pressure. Combining customer research with data analysis, the team developed machine learning methods using past breakdowns to identify potential causes and predict future occurrences. Slotting these models into Valmont's existing irrigation management system means that growers and dealers can be proactive in addressing breakages, and Valmont can identify trends for future product development and marketing purposes.

Student Team

Taylor DeMint
Dean Ziegelman
Ayush Mishra

Jacob Morrow
Steven Silgado



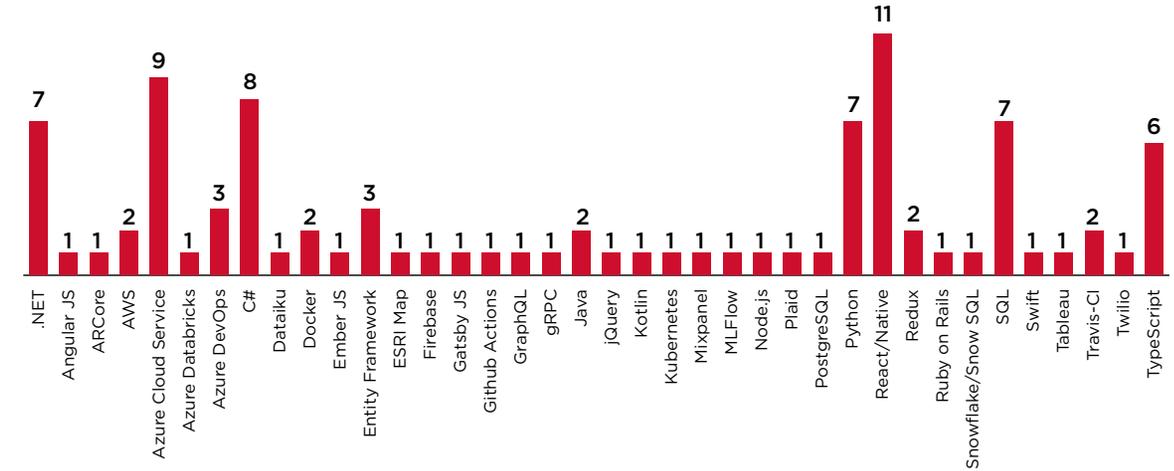
DESIGN STUDIO

Statistics



Project Technologies

SOFTWARE USED



NUMBER OF TECHNOLOGIES USED

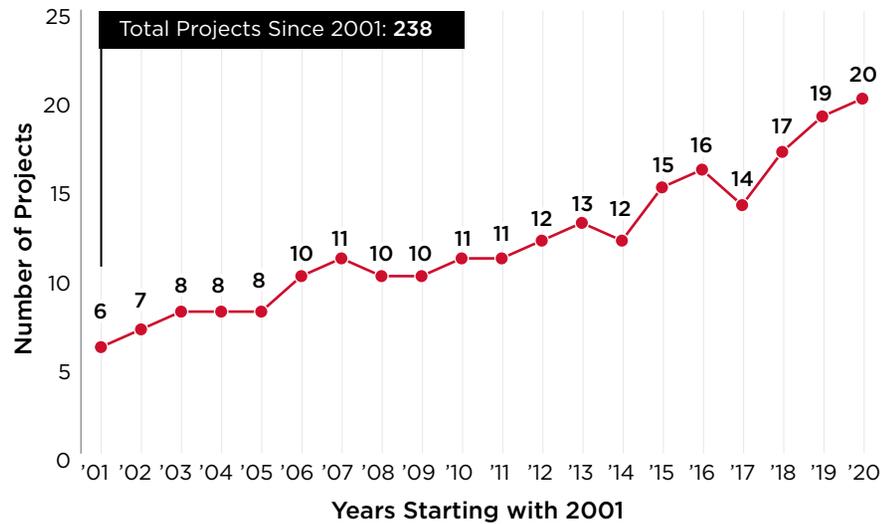


CLOUD PROVIDERS

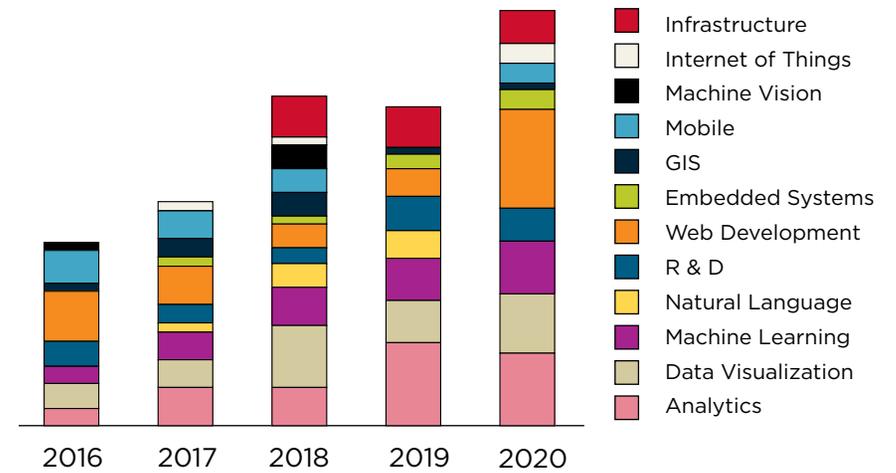
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- AWS
- Google



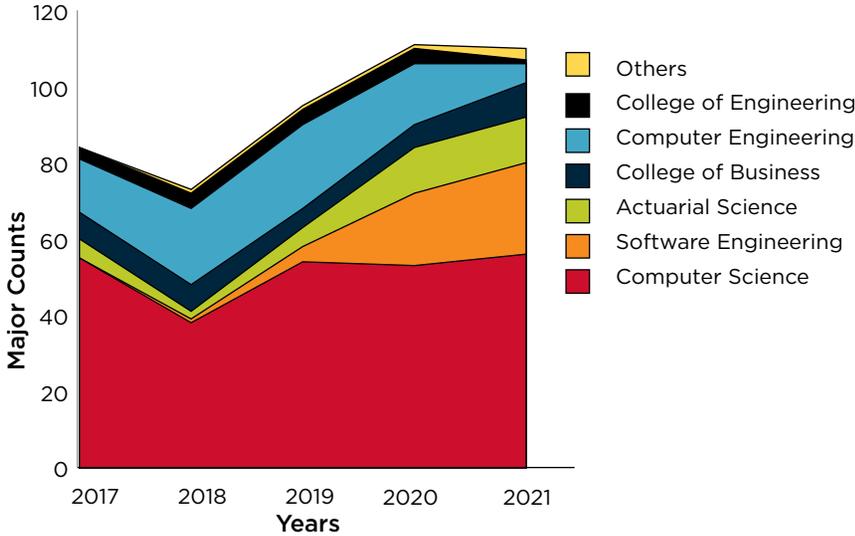
Project Count



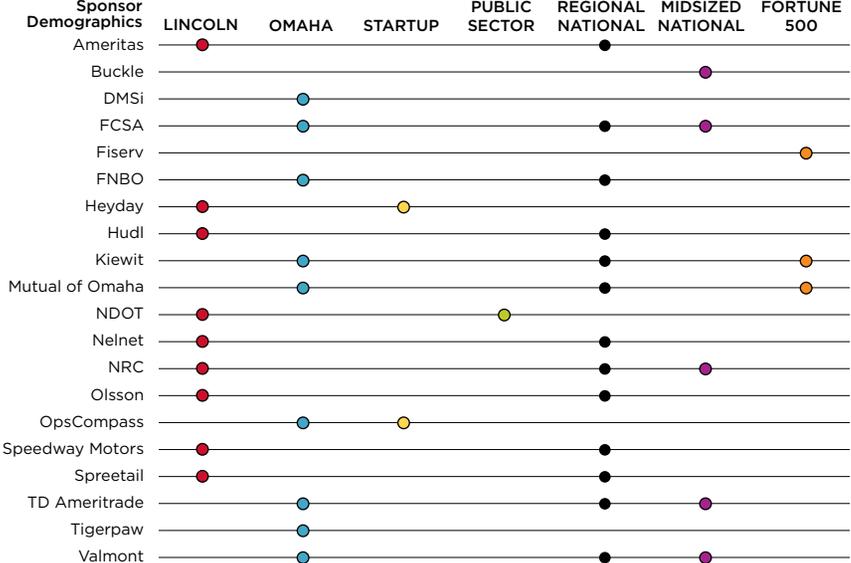
Project Domains



Programs of Study



Sponsor Market Sectors



Design Studio Students

Jarod Aerts	Andre Garivay	Quinn Lennemann	Brian Reynolds
Keenan Allen	Dom Giandinoto	Sheng-Jie Lim	Caleb Ricketts
Ian Anderson	Jacob Gideon	Antonio Linhart	Mary Clare Rogers
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Kylie Becker	Jessie Guo	Jacob Mann	Parker Segal
Anthony Benes	Levi Hagen	Maria Maxon	Steven Silgado
David Besonen	Achintya Handa	Erica Mays	Navya Singh
Hundter Biede	Ben Hanson	Caitlin McCarthy	Nick Siscoe
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Landon Borges	Uri Herszbaum-Harding	Vishnu Menon	Ben Stuart
Tommy Braccia	Audra Heyne	Emma Mirnics	Jacob Sullivan
Christopher Burbach	Anna Holmquist	Ayush Mishra	Sifat Syed
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Joey Carrigan	Connor Jolley	Shivani Mudhelli	Danny Tran
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Emma Clausen	Aayush Khatiwada	Nick Nguyen	Matt Vavricek
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Taylor DeMint	Brady Klein	Rachel Nordgren	Ben Wingerter
Laura Derowitsch	Michael Kovar	Ryan Olsen	Ryan Wolff
Stan Drvol	Clare Kramper	Jacob Peddicord	Megan Wright
John Earnest	Kyle Krueger	Andrew Phares	Bennett Wright
Jimmy Erickson	Ryan Lampe	Lara Quiring	Dean Ziegelman
Luke Farritor	Katie Leger	Max Radlicz	
Sierra Futterman		Allie Rauner	

Design Studio Coaches

Name	Company	Project
Bill Anderson	Microsoft	Valmont
Joel Brehm	Bolero Information Systems	FNBO
Todd Bryant	Retired	Ameritas
Lou Anne Daugherty	Nebraska Department of Transportation	Tigerpaw
Nick Ebert	Spreetail	OpsCompass
Andy Giese	Integrated Informatics Inc.	Buckle
Jeff Hale	Agilx	DMSi
Jake Heidelk	Spreetail	TDA
Nick Hershberger	Ameritas	Hudl
Rees Klintworth	Hudl	Farm Credit
Tarryn Moss	Hudl	Olsson
Santi Murtagh	Opendorse	Fiserv
Rob Nickolaus	Arbor Day Foundation	Spreetail
Everett Rhodes	Don't Panic Labs	Speedway
John Roby	Allstate	NDOT
Ashlyn Slawnyk	Hudl	Nelnet
Carl Steffen	Cornhusker Bank	Kiewit
Sherry Weber	UNL - ITS	Mutual
Matt Will	Spreetail	NRC Health
Brian Zimmer	Don't Panic Labs	Heyday

DESIGN STUDIO

Students & Coaches



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