



RAIKES SCHOOL
DESIGN STUDIO

Combining Strengths to

SHAPE THE

FUTURE

2022-2023 Design Studio Annual Showcase



What is Design Studio?

In the heart of the Jeffrey S. Raikes School of Computer Science and Management lies Design Studio, the capstone program that partners leading industry sponsors, new innovative startups, and researchers with the best and brightest students to dream and build high-tech solutions for today's business problems.

Our Approach

As an experiential learning program, Design Studio brings together third- and fourth-year students to work in teams to create, grow, take chances, and build new products for industry partners, nonprofits, and student-led startup businesses.

This report showcases the past year in Design Studio:

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LETTER from the DIRECTOR



Cheryl Nelson
Director of Design Studio

WE BELIEVE THAT TOGETHER IS BETTER.

In Design Studio we combine our strengths to shape the future. We mix grit with creativity and logic. We meld experience with innovation. We combine students from multiple majors, diverse backgrounds, and various interests. We team them up with industry mentors who coach them on best practices and problem-solving techniques. Our capstone program is the place where it all comes together.

Our aim is to create leaders who are ready to shape a better future. We have expanded this focus by giving entrepreneurial students time, space, and guidance as they turn their ideas into products, companies, and services. Our curriculum encourages students to embrace an entrepreneurial mindset and to look for new ways to solve problems. Some of our students are fulfilling their capstone requirements by focusing on research. And for the first time, three students studied abroad while participating in Design Studio.

It has been quite a year. We have harnessed a unique combination of strengths to make it all happen. This included adding new staff, enriching mentorship with an entrepreneurial panel, and introducing more opportunities for students to connect to executive sponsors. We have hosted guest speakers in our classroom and given students more choices about what and how they learn. We are constantly iterating and improving our processes, building on the past and keeping an eye on improving the future.

Looking back at the year, we are proud of how our teams rose to the challenges put before them. We have witnessed students with novel product ideas develop their concepts into a working prototype. New leaders rose to the challenge of managing students across time zones and established a new standard. Teams learned how to shift to changing demands in their product space and create business value for their sponsors. Our startup teams have learned how to find the right product-market fit.

Looking forward, it is clear how Design Studio, along with its sponsors and volunteers, is providing opportunities for our students. These students are joining the workforce with interdisciplinary skills, a drive to create business value, and the ability to make a difference in their respective fields.

We are all thankful for the foundation of community support that empowers the collective success of this program. Our project partners are generous with financial support, and their willingness to share their talent, time, and expertise. This collaboration is instrumental in providing opportunities to students so we can achieve our goal of shaping a better future.

We are all better together, and I can't wait to see where we go next!

Cheryl

Capstone Program

30

Weeks

20

Sponsors

12-15

Hours Per Week

5

Students Per Team

4

Faculty

3

Student Startups

2

Semesters
(Fall and Spring)

1

Coach and Program
Lead Per Team



Project Timeline

Project Initiation

Objective: Become acquainted with sponsor and project. Determine process for execution of project.

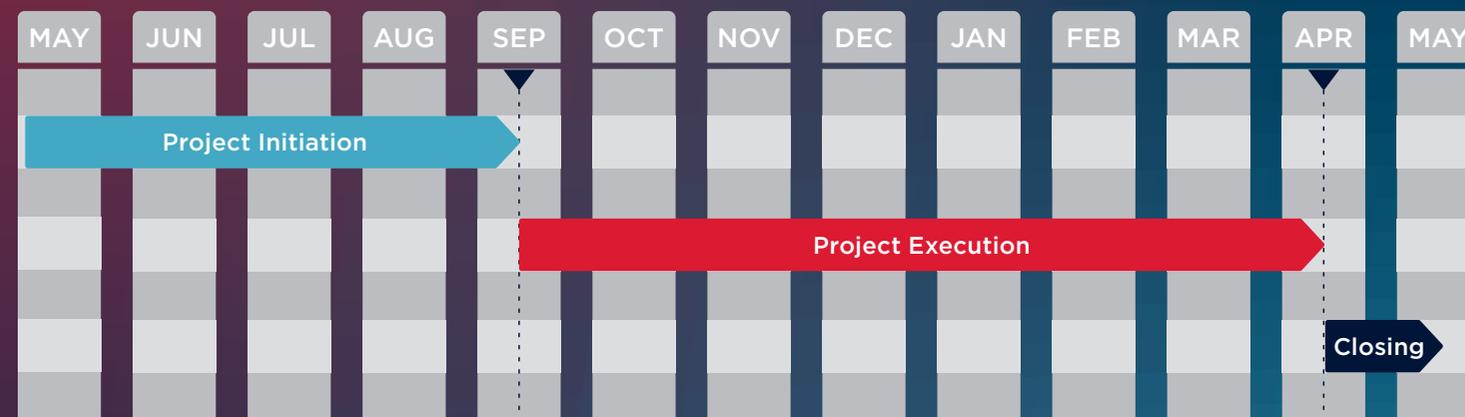
Project Execution

Objective: Produce value for sponsor through cumulative iterations.

Checkpoints/Releases: 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.



PROJECT INITIATION

May: As soon as showcase concludes, we begin lining up projects for the next year. Many of our partners are so committed to the program they come back year after year. Others are new businesses that have needs identified in the community. The staff works with potential partners to select and right-size projects for an academic setting. Also in the spring, students pitch their plans for a startup business in a competition to win the opportunity to bring their idea to life in Design Studio.

June/July: Projects are confirmed and statement of work agreements are completed.

August: Sponsors and coaches gather for a summit and projects are each assigned a product manager and development manager. Classes begin and project rollout is held which is a career-fair style event where students learn about the projects to discern the best fit.

PROJECT EXECUTION

September: Teams form, set up their workspaces, and begin to build their vision for the project.

October: Release 1

November: Release 2

December: Release 3

January: Semester 2 Kickoff

February: Release 4

March: Release 5

April: Release 6

PROJECT CLOSING

May: Showcase and Review



Great partners. Great possibilities.

This year our industry sponsors provided a wide array of business problems for our students to solve with technology-based solutions. With a focus on developing the next wave of talent to enter the workforce, our industry partners work with us to bring forward a wide array of challenges in a number of technical domains.



Allo Communications

Design a solution to streamline the resolution of construction issues.



Center for People

Sponsored by Spreetail Foundation

Help remove barriers to employment by helping the Center for People build a unique job platform.



DMSi

Streamline the future of the building materials supply chain with artificial intelligence.



Farm Credit Services of America

Visualize dynamic geospatial data science calculations through a modern Web app.



First National Bank of Omaha

Help small business owners take control of their day-to-day finances so that they can focus on their own personal version of success.



Fiserv

Build a secured consent platform, user experiences, and immutable ledger database for creating secure interactions between Fiserv financial institutions, account holders, and fintech applications.



Hudl

Make Hudl a must-have tool for athletic directors to use to find insights into their athletic programs and connect with their coaches, athletes, and fans.



Kiewit

Help Kiewit keep people safe by creating a rover that can explore confined spaces so that humans don't have to.



Medical Solutions

Improve patient care by designing a solution to predict future healthcare staffing needs.



Mutual of Omaha

Design a solution to predict whether customers will leave and implement measures to keep them.



Nebraska School Activities Association

Improve upon a solution for a more efficient system of maintaining high school registration, eligibility, rosters, contacts, reports, and archives.



Nelnet

Create a user-friendly input and output application that combines with Velocity to provide a one-stop shop/informational outlet for Call Center and Processing Agents to service customers efficiently and accurately.



Olsson

Help architects, engineers, and construction teams work smarter by accelerating the modeling of the real world in digital space.



Signature Performance

Data visualization of sentiment analysis to monitor and assist calls with veterans.



Speedway Motors

Improve the visibility of inbound inventory and optimize its placement at distribution center locations.



Spreetail

Provide a clear view of the status of inventory within a fulfillment center.



Union Bank & Trust

Create a model that helps them understand what variables determine bank branch placement and closure.

Startup Studio

Three student-led startup businesses became Design Studio projects this year. These projects were chosen during a pitch competition the prior year and funded by a group of generous individual sponsors. The goal of startup studio is to allow students the time and resources needed to focus on starting their own business and to give students the experience of working at a startup. This spirit of entrepreneurship in turn inspires all students to lean into ground-breaking innovative solutions.



Beacon

Develop an autonomous, non-GPS reliant, drone system for safer bridge inspections.



Dyslexico

Leverage machine-learning technology to provide seamless spelling and grammar corrections that are tailored to the dyslexic mind.



Tapp

Develop a native application that coaches and players can use to track and evaluate player performance.

Research Studio

This year, two students participated in Research Studio, our interdisciplinary research capstone experience. They worked with faculty mentors throughout the University to lend their unique computer science and management skills towards research efforts in their mentor's area of expertise. Their respective projects have helped to break new ground in autonomous driving safety and plant phenotyping, and support their individual marches towards an academic career.

AT A GLANCE

PROJECT DOMAINS

	PROJECTS	Allo	Beacon	Center for People (SpreeTail Foundation)	DMSi	Dyslexico	Farm Credit	FNBO	Fiserv	Hudl	Kiewit	Medical Solutions	Mutual of Omaha	NSAA	Nelnet	Olsson	Signature Performance	Speedway	SpreeTail	Tapp	UBT
Analytics	4											•					•	•			•
Business Automation	6	•												•	•		•	•	•		
Data Science	2		•										•								
Data Visualization	6	•								•		•				•			•	•	
Geographical Info Systems (GIS)	2		•																		•
Internet of Things (IoT)	2										•					•					
Mobile App Development	4	•					•	•												•	
Machine Learning	4				•	•						•									•
Natural Language	2					•											•				
Research and Development	4								•				•		•						•
Systems Engineering	2		•								•										
Web Development	8			•	•	•	•		•	•			•	•							

STUDENTS' MAJORS

Accounting	1
Actuarial Science	6
Business Management	2
Computer Engineering	3
Computer Science	59
Economics	2
Finance	4
History	1
Integrated Science	6
Marketing	1
Mathematics	12
Mechanical Engineering	3
Software Engineering	15

INDUSTRIES REPRESENTED

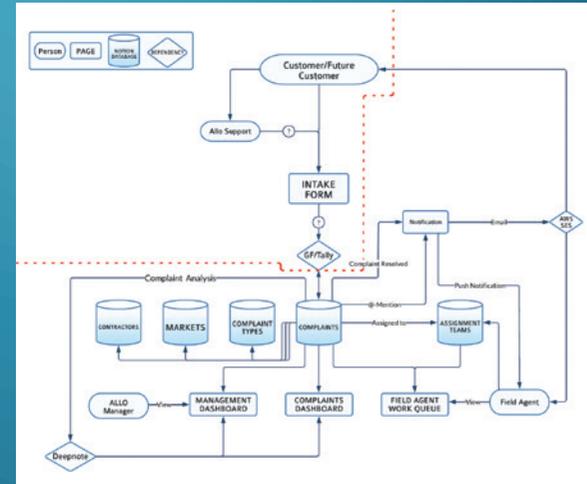
Aerobotics	1	Government	1
Ag Tech	1	Public Interest	1
Construction	3	Medical Tech	2
E-commerce	1	Nonprofit	1
Engineering	3	Insurance	2
Fiber Broadband	1	Supply Chain	1
Fintech	4	Transportation	1



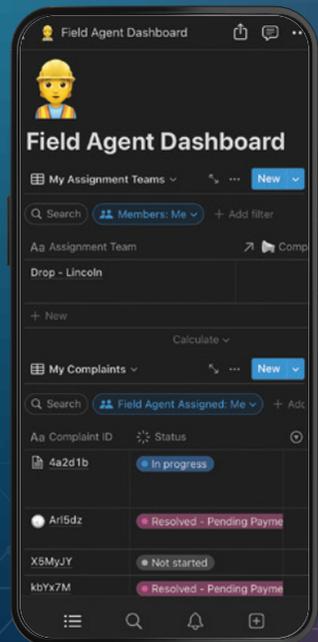
Complaint Resolution

ALLO is a Lincoln-based, all-fiber optic Internet, TV, and phone company. The company provides services to business, residential, and governmental customers in Nebraska, Colorado, and Arizona, and continues to grow rapidly. ALLO's core values of honest, exceptional, local, and hassle-free service significantly influenced the project.

In the current growth phase, ALLO is receiving approximately 1,000 construction and installation complaints from customers or future customers per month. The previous workflow for these complaints was an online webform submission where responses were added to a Smartsheet. ALLO employees then read through submissions to manually evaluate and dispatch them to ALLO field agents. Field agents also worked in the Smartsheet to update progress on the complaint. This process was time-consuming for both customers and employees.



Architecture map of project scope.



Mobile view of a field agent's dashboard to view and update their assigned complaints.

TEAM

Sophie Hellebusch
Sophie Hill
Erik Konnath

Hannah Pokharel
Sam Rangira



Talent Marketplace

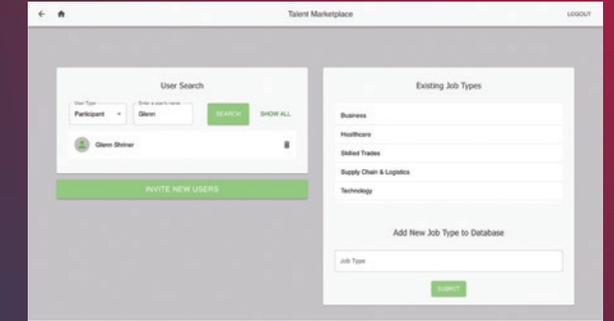
The Center for People is a nonprofit organization that provides services and programs to low-income people to help them meet their basic needs and achieve economic independence. One such program connects participants with work training and potential employment opportunities. Previously, the Center for People had no platform to connect their trainees and employers.

To combat this problem, the Design Studio team has created a "reverse job fair" Web application that allows businesses to search for qualified participants that have been through training at the Center for People. Administrators can invite both employers and participants to the system, where they can create profile pages. For employers, their page has an "about" section, a profile picture, and information on which job types they

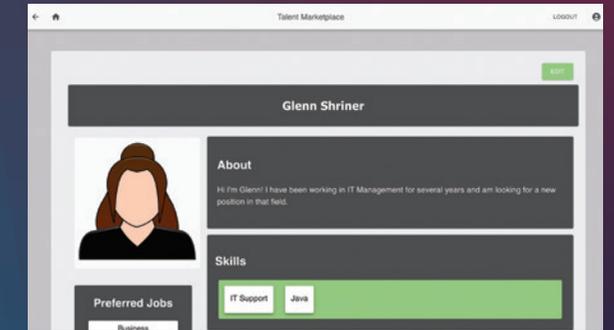
TEAM

Arnaaz Brar
Anna Krueger

Ben Lohrman
Mitra Vajjala



Administrator dashboard page.



Participant profile page.



Employer discover page.



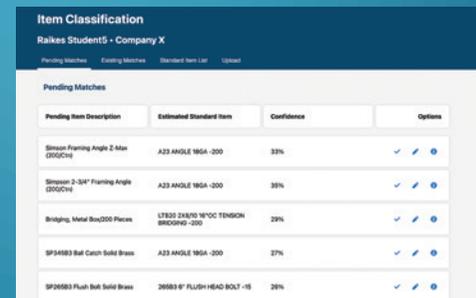
Item Standardization Using Artificial Intelligence

DMSi is independently owned, privately held, and completely dedicated to the lumber and building materials industry. They put decades of experience to work building solutions that help customers better serve their customers. DMSi is inspired by technology, passionate about service, and excited about the future of this industry.

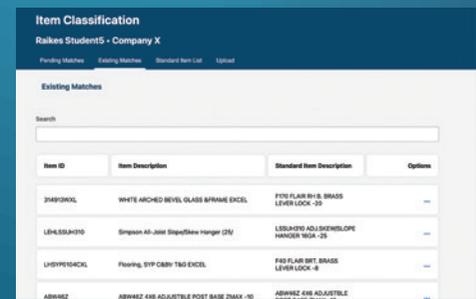
DMSi has been in the enterprise resource planning business for building materials suppliers for decades with their flagship application called Agility. Their customer base includes a large portion of the building material supply chain in North America. For companies in the industry to conduct business with each other electronically, they need to cross reference their products and their desired unit of measure. When companies carry anywhere from 10-100 thousand products, cross

referencing their entire catalog can be extremely time consuming and costly.

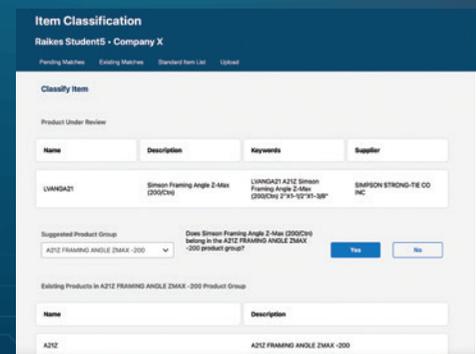
To address this, the Design Studio team created their vision statement: "To create an algorithm and user interface to classify construction materials in order to optimize the material classification process leading to saved time and money." To execute this vision, the team created a new concept, a Standard Item Group (or SIG). Instead of a person making one-to-one connections with another company's products, the algorithm will now assign each of their items with a SIG. Once connected to a SIG, cross references to all other items in that SIG will be created in Agility. If our algorithm isn't confident in its analysis, it will send the item to the user interface for manual classification.



This view contains all the items which will need manual classification as well as recommendations.



This view shows all the currently classified items and the group assignments.



This view shows more details about the item up for manual classification as well as examples of items already classified.

TEAM

Samuel Atkins
Angeline Luther
Justin Morrow

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Daniel Noon



Ag Sustainability Profiler

Farm Credit Services of America is a leading provider of credit and insurance services to farmers, ranchers, agribusinesses, and rural residents in the Midwest. In search of a new way to serve their customers, Farm Credit wanted to enable farmers to pursue more sustainable practices.

Apart from reducing a farm's carbon footprint, eco-friendly techniques can also be leveraged to make a profit. For example, a producer can earn carbon credits by adopting new approaches such as not tilling the land, adding cover crops, diversifying crop rotation, or improving nitrogen timing. Once these practices are verified and a farmer earns the carbon credits, they can be sold as part of a contract for extra income. The estimated size of the U.S. market for carbon credits is \$5.2 billion annually.

One major roadblock for farmers is the collection and compilation of their data. There are numerous carbon credit verifiers, each with its own set of required data points. This process can be so intense that farmers often get discouraged when starting their application and walk away.

To ease this process for farmers, the Farm Credit Design Studio team conducted in-depth research surrounding the carbon credit market and distilled the most common data points needed across verifiers. Using this data, the team built a database and Web form from the ground up to hold all the relevant information. Now, Farm Credit customers have a one-stop-shop for all the most relevant data and can easily start the once-daunting carbon credit application process.

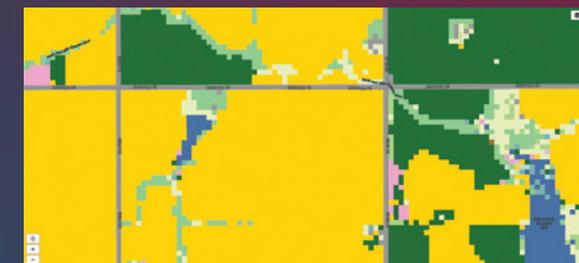
TEAM

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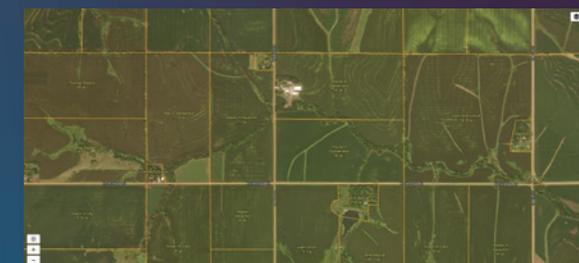
Nick McElroy
Alex Miller



Map component with soils layer selected.



Map component with crop land layers selected.



Map component with field boundaries layer selected. Users can select their fields to gather data.



Monty

FNBO is an independent, family-owned bank based out of Nebraska. For 165 years, FNBO has been helping individuals and communities improve their financial well-being. FNBO's community focus includes helping small businesses within local communities.

The team was challenged to create an application called Monty which aims to help small businesses track and manage expenses. The goal of Monty is to provide the services of a CFO for a small business. This will allow small business owners to spend less time tracking finances and allocating money for different parts of their business and let them do what they enjoy.

The team created a user interface/ user experience front end for Monty. Our vision was to create a front-end

application leveraging a modern front-end framework that streamlines financial management for small business owners by optimizing user experience. The team used ReactNative alongside Figma, Redux, and other tools to bring the application to life. These tools, alongside several customer interviews, allowed the team to create an engaging and intuitive end product.

The next steps for FNBO are to continue back-end development that securely connects customer information to the front-end application. Then small business owners will be able to create and track projects, clients, and expenses. The projects will be updated in real-time as purchases are made or clients pay the business for their services.

TEAM

Dillon Howell
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Praveen Rao

Jayden Rocha
Andy Zhang



CyberTrust App - Immutable Consent Framework

Fiserv is a global fintech leader in payments and financial technology providing solutions to thousands of financial institutions and millions of businesses in areas such as digital banking, account processing, and more.

Today, consumers are connecting their financial account logins to third-party apps which offer engaging experiences beyond what most banks and credit unions deliver. However, many of these apps are gaining access to more data than is necessary for the app to deliver the service.

The challenge for the Design Studio team was to create an app to help protect consumers by letting them decide what data may be used by third-party fintech apps.

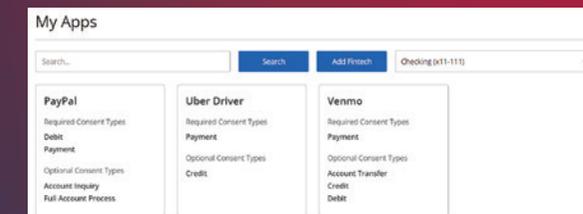
The team designed an app called CyberTrust which helps consumers manage access to their financial data by limiting what can be obtained by third-party fintech apps using an immutable consent framework.

CyberTrust begins the process by assisting the user in the creation of a consent form. This consent form specifies which accounts, activity, and data will be shared with each individual fintech app. Then the app provides explicit, granular consent to the third-party fintech app specifying the financial data to which it has been granted access. This consent detail and all activity is stored in an immutable database record for historical purposes.

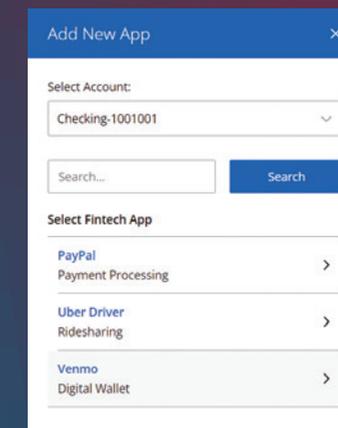
TEAM

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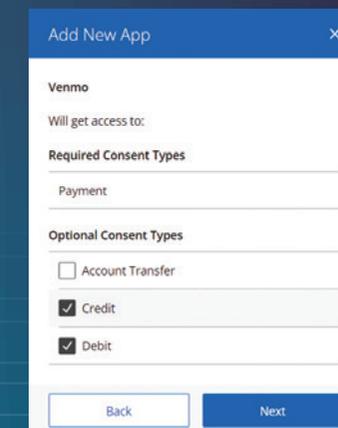
Blake Simpleman
Khondamir Umarov



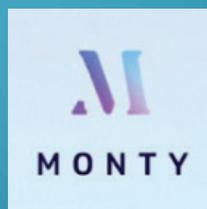
Account holders see Fintechs they consented to, and can grant consent to new Fintechs.



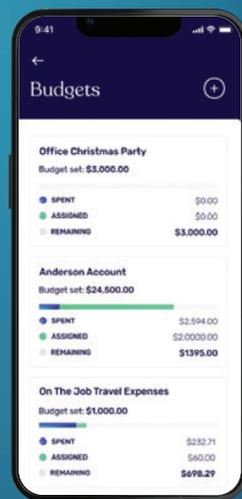
Users choose which account and what data may be accessed by the app.



Users complete this consent form to determine which data the app can access, then a unique code will be generated.



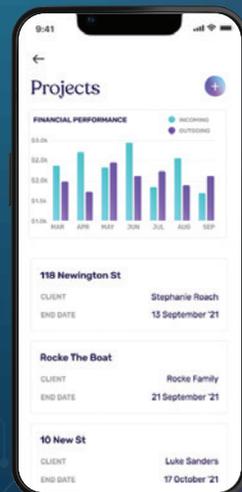
Monty is a digital CFO for small project-based businesses designed to help them control, analyze, plan and support their business.



Users can track and manage expenses in the mobile app.



The dashboard provides an overview of business performance.



This page provides more details on projects in progress.



Hudl Athletic Director Experience

Hudl historically caters to coaches, athletes, and fans across the globe. However, the primary decision maker—athletic directors (ADs)—have not been given proper attention. Hudl is considering a new suite of products for ADs. The Design Studio team has been tasked with tackling one of the most frequently asked questions from ADs: “Are my teams actually using Hudl? If so, how are they using the tools?”

The Design Studio team created Hudl Skybox, an interactive athletic director dashboard experience. This new tool aggregates the usage data from all the school’s Hudl accounts and presents insights in a clear, concise, and flexible interface. Doing so will help ADs hold their coaches accountable, connect with athletes, and justify their Hudl costs to stakeholders.

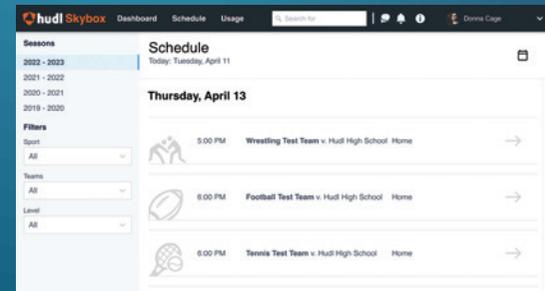
The homepage uses a completely customizable widget framework that

grants ADs complete autonomy over the data that’s most important to them in a layout that suits their viewing style. Hudl Skybox also contains an aggregate schedule of the school’s sporting events which helps ADs ensure accurate scheduling with a quick glance. The platform is complete with a more detailed usage page that allows ADs to dig further into individual team habits.

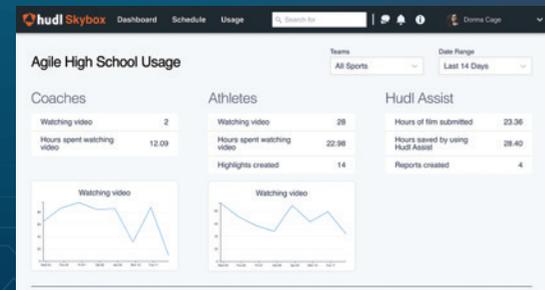
On the surface, this project creates value for ADs through an increase in visibility to data. At its core, Hudl Skybox allows ADs to make more informed decisions. From renewing their Hudl package to managing coaches and celebrating athletes, this dashboard ensures athletic departments across the country are using Hudl to its fullest potential. Hudl Skybox was designed with the help of several AD interviews and will serve as an excellent proof of concept going forward.



On the landing page, metrics are presented in visually relevant charts and graphs to help athletic directors immediately spot trends.



The schedule page displays an aggregate of games and sporting events across the athletic director’s entire school.



The usage page provides a more detailed view of how the entire athletic department is using Hudl services.

TEAM

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Isabelle Schmidt



Confined Spaces Rover

Kiewit is a world-renowned construction company that leads the industry in safety. Each construction site has areas called confined spaces. A confined space has limited entry and exit and is not designed for continuous human occupancy. However, employees need to enter them to complete jobs such as welding, painting, or data collection. Confined spaces can have hazardous atmospheric conditions, making it dangerous to send humans into them. While Kiewit currently takes numerous precautions to keep their employees safe in confined spaces, they want to eliminate the need for humans to enter them altogether.

The vision for this project was to build a rover to collect data from confined spaces, thereby mitigating dangerous situations where Kiewit employees are exposed to toxic atmospheric conditions with limited entry and

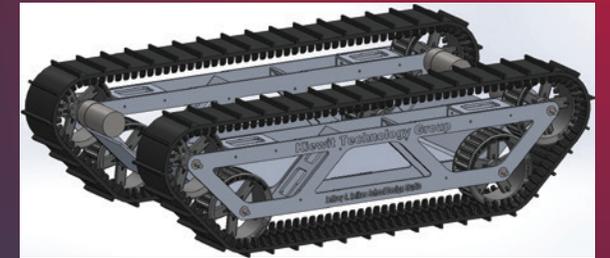
exit. The team set out to design and build a prototype rover equipped with a basic sensor suite including a camera, telemetry, and atmospheric sensing. In addition to building the physical vehicle, the team developed an integrated system to operate it, transmit data, and store the data.

The rover is connected to a mothership via a tether which enables communication from the mothership to the vehicle even when the rover is underground. The mothership hosts two Web applications. One application controls the rover and collects data, while the other application stores the data and uploads it to Kiewit servers. Using a wifi-capable device, Kiewit employees will connect to a network hosted by the mothership, access the first Web application, and control the rover.

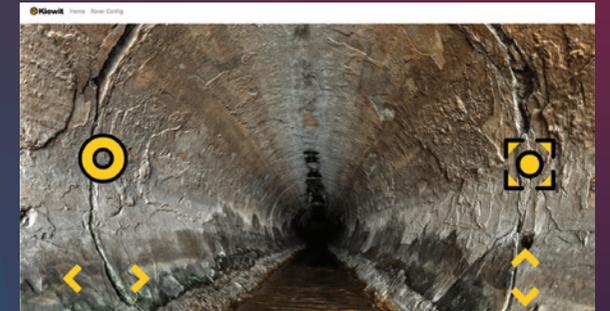
TEAM

Will Anderson
Dylan Araujo
Kally Karkazis

Jay Patel
Samuel Schneider



Rover design using solidworks.



Rover control application hosted on motherboard.

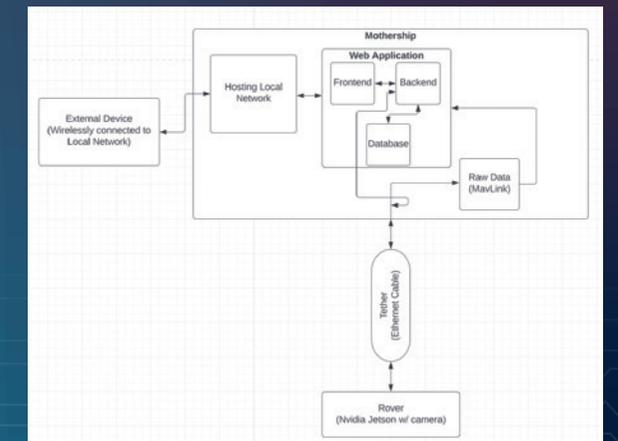


Diagram of rover and mothership connection.

Medical Solutions™

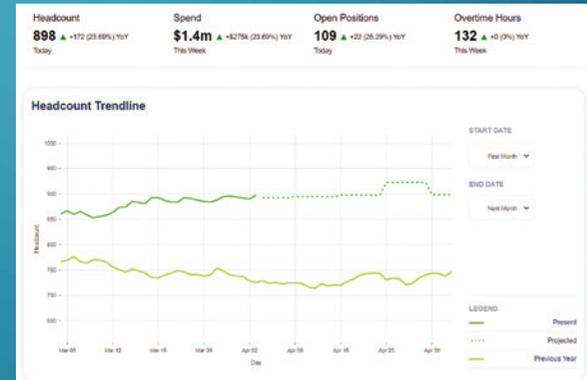
Clinician Staffing Dashboard

Hospitals often struggle to hire enough nurses to meet their patients' needs, so they rely on travel nurses to fill in the gaps. Travelers work for hospitals on a temporary basis and are frequently used to meet urgent staffing needs. Medical Solutions connects hospitals with a network of thousands of travel nurses and other clinicians, streamlining the hiring process. Unfortunately, hospitals find it difficult to determine how many travelers they need and when they need them. It's a reactive process that produces poor care and stressed nurses.

The Design Studio team addressed this problem by building an intuitive and extensible dashboard targeted at hospital directors and executives. The dashboard enables leaders to make data-driven staffing decisions by visualizing data related to travel nurses and other clinicians. Previously,

detailed staffing data was only available to leaders on a quarterly basis; however, this dashboard enables instant access to insights. By interviewing several potential users, the team identified key metrics (headcount and spend) and effective ways to communicate those metrics. Additionally, the team engineered the dashboard for easy future expansion.

While building the dashboard, the team also conducted extensive research on machine-learning methods for predicting future staffing needs. This research was packaged into a document outlining potential obstacles and promising strategies. Medical Solutions plans to use the team's findings to produce accurate projections that are displayed on the dashboard. Leaders can use these projections to ensure their hospitals will be appropriately staffed in the future.



Hospital executives use this graph to analyze historic trends and anticipate future staffing needs.



These pie charts help users understand where travel nurses are needed most within an organization.



The team used Python, Pandas, Delta Lake, and Databricks extensively while experimenting with headcount projection models.

TEAM

Nathan Gentry
Garrett Parker
Zac Streich

Khoa Tran
Elizabeth Weber

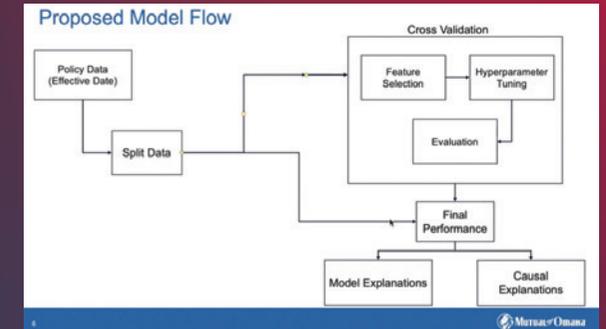
Persistent Customers

Mutual of Omaha life insurance policyholders must pay their premium in order to retain the policy they have purchased. If a policyholder misses a payment, they are considered to have lapsed on their policy and will lose the value of the premiums they have paid thus far.

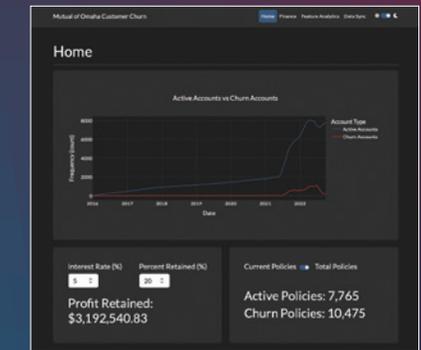
The team addressed this problem with a machine-learning model that can identify customers that are likely to lapse. In addition, the team generated financial results and statistical insights related to the entire group of policyholders. The team developed a financial information dashboard that reports on revenue and profit correlated with each potential policyholder. Now, Mutual

of Omaha can use the dashboard to adjust the interest rate and retention effectiveness rate in order to see the financial impact on the business.

Equipped with this model, Mutual of Omaha can direct their retention efforts more effectively which will improve their long-term profitability. This will be beneficial for the policyholder because they won't lose out on the premiums they have already paid, and Mutual of Omaha will retain a customer they would have otherwise lost. These models could also be used to identify lapses in other lines of business that Mutual of Omaha has, which could provide even greater retention across all their policies.



Repeatable process for pre-processing, training, and validating machine-learning models.



Overview of active vs churn accounts; highlighting profit retained.



Breakdown of dataset for analyzing trends related to features.

TEAM

Megan Chaffey
Cole Johnson
Lauren Kasperek

Joshua Madsen
Ryan Orth

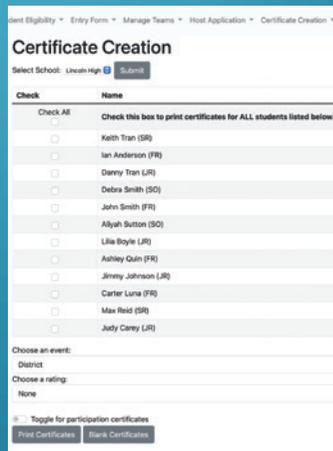


Web 2.0

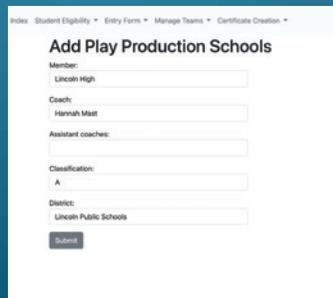
The Nebraska School Activities Association (NSAA) is the sanctioning body of high school athletics and activities in the state. With over 300 public and private schools in the state of Nebraska taking part in the organization, the NSAA maintains an extensive amount of data to organize, develop, direct, and regulate interscholastic activities.

As time progresses, the integrity and reliability of this data becomes more crucial to sustaining the NSAA purpose. In an effort to revitalize their systems, NSAA is collaborating with Design Studio to improve and revamp their current software to manage interscholastic activities.

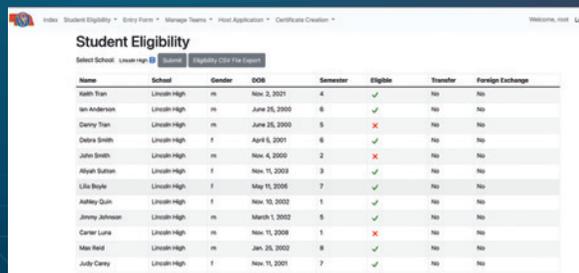
As part of this multi-year project, the Design Studio team embarked on



This page helps coaches and athletic directors create certificates for eligible students from their school in specific activities and ratings.



Activity directors and NSAA administrators enter eligible schools for activities and include all relevant details for that school.



This page shows a school's student eligibility, based on parameters, and it can only be altered by NSAA administrators.

TEAM

Emily Dalton
Carly Gove
Vivian Jacobitz

Clare Kramper
Viet Ninh



Clarity

Nelnet Consumer Services is a full-service originator and servicer of private educational and personal loan products. Currently, Nelnet stores and updates lender and loan program details in a large number of spreadsheets, work guides, questionnaires, and Confluence pages. These many sources create challenges for administrators who update and maintain the data. The scattered data also creates problems for call center agents, who want to help customers as efficiently as possible, but need to switch between multiple applications to find answers.

To address these challenges, the Design Studio team created Clarity, a central knowledge base for lender and loan program information. In Clarity,

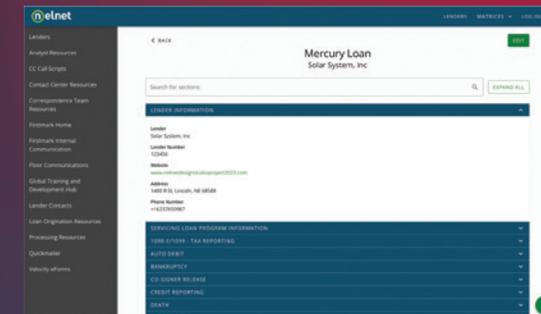
users can easily search for a specific loan program and view its details. Clarity also provides matrix displays that help users quickly compare different loan programs. With all this information at a glance, call center agents can effectively help customers make the best financial decisions.

Clarity also provides features for administrators to easily manage loan program data. Instead of needing to change multiple spreadsheets, documents, and webpages, administrators can update loan program documentation in Clarity. This change will improve administrators' experience and guarantee that users receive the most up-to-date information.

TEAM

Ariel Levi
Toan Nguyen
Francis Nzivugira

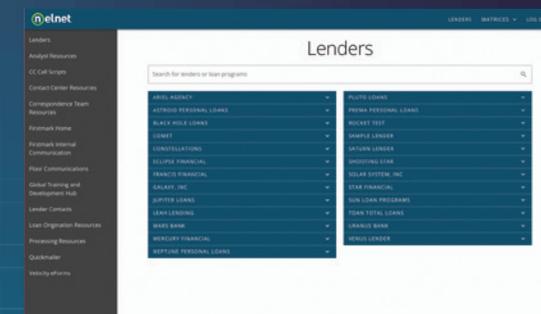
Leah Olson
Prema Vasudevan



The loan program page displays a loan program's information and allows admins to edit it.



Clarity displays several matrix pages that allow call center agents to compare different loan programs' terms.



Clarity's lenders page gives call center agents a quick overview of lenders and loan programs.



Project ZeroDelta

Olsson serves many clients in facility planning, design, and construction. Project ZeroDelta aims to address Olsson's challenge of using 3D data for construction planning.

When designing buildings, Olsson stores data as 3D object files. When scanning buildings on-site, LiDAR scanners store data as point clouds. While the human eye can differentiate these two data types, a computer cannot.

Because of this, auditing the progress of a building to its plans involved a process where Olsson employees manually searched for differences, recorded them, and then reconciled these differences by editing designs. It quickly became apparent that this process was time-consuming, costly, inaccurate, and prone to error, which scale would only worsen.

With all this data at their disposal, Olsson determined they needed a better way to utilize what they collected and a streamlined process of matching designs with reality.

Olsson challenged their Design Studio team with developing a minimum viable product that compares 3D data files and finds meaningful differences for users. First, the application looks for any items that are missing. Next, an algorithm finds "hot spots" of points where any unplanned objects are detected. Then, the app displays this to the user so that they know exactly what is different between the two stages of a facility.

Overall, this solution automates the capture and detection of differences between planned models and images of reality, which gives time back to Olsson personnel and empowers Olsson to deliver efficient and insightful design decisions.

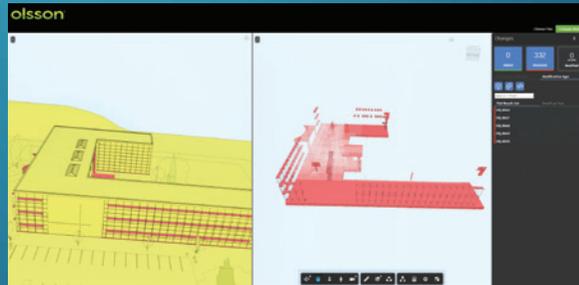
TEAM

Jessica Chen
Harish Krishnappan

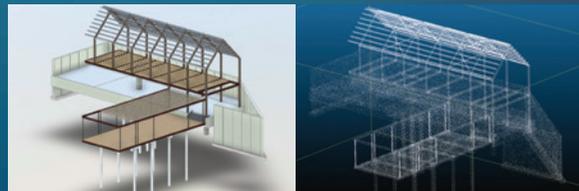
Devin McGuire
Damien Niyonshuti



The logo for our application.



The calculated differences between two buildings as well as just the objects that have been removed.



A 3D model of a building and a point cloud generated from it.



A point cloud before and after categorization by object.



Contact Center AI Sentiment Analysis

Signature Performance, Inc., (Signature) is a leading provider of healthcare administrative solutions and services. Since its inception in 2004, Signature's foremost solutions and services are utilized by many of the country's most respected provider, payer, and health IT organizations in the public and private sectors.

This year's project involves the operation and innovation of the contact center experience. Signature handles over 250,000 healthcare-related calls per month. While conducting calls for customer service and provider relations, Signature's Experience Center representatives episodically encounter callers expressing suicidal ideations or utterances. Signature's commitment to providing the best possible service to callers extends to ensuring caller safety, especially in these moments of crisis to transition calls quickly and efficiently to services best suited for their needs.

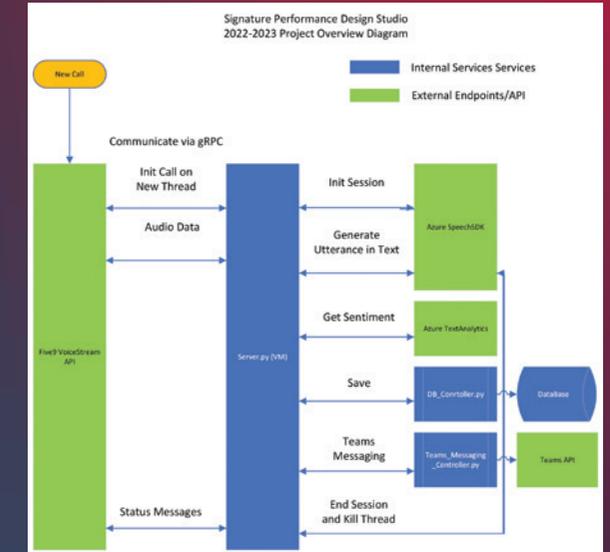
TEAM

Caleb Burbach
Kellen Carney
Carl Olson

To deliver industry-leading client satisfaction to these callers, initial Design Studio team-tasking involved development of a Suicidal Ideation and Homicidal Ideation model to decrease response times, streamline transition time, increase satisfaction, and produce better health outcomes.

This year, the team was tasked with taking the project the last mile: getting it ready to move into production by adding sentiment analysis, Microsoft Teams messaging, and most importantly, scaling the infrastructure to work with a magnitude of concurrent calls. In particular, the software the team developed handles numerous concurrent calls, where negative call sentiment data is analyzed and/or a call being flagged as a crisis is escalated in the crisis notification pipeline. The call metadata is sent within HIPAA regulations across other applicable, secure channels. From there, the customer service representative and manager can assist in the most appropriate way possible.

Matt Radlicz
Colin Safford



High-level overview of what the system does, from when a call starts to storing the data and sending teams messages.

scoreID	posScore	negScore	msgScore	callID	utterance	isSuicidal	calling	
1	99	0	0	3000000001125	I am feeling really happy.	0	1	
2	0	0	100	3000000001125	I am feeling really sad.	0	1	
3	97	2	1	3000000001125	I'm having a great day.	0	1	
4	4	0	99	3000000001125	I am super depressed.	0	1	
5	99	1	0	3000000001125	I am feeling really happy.	0	0	
6	7	0	100	3000000001125	I am feeling really sad.	0	0	
7	0	97	2	1	3000000001125	I'm having a great day.	0	0
8	9	0	99	3000000001125	I am super depressed.	0	0	
9	15	99	1	0	3000000001125	I am feeling really happy.	0	0
10	12	0	100	3000000001125	I am feeling really sad.	0	0	
11	13	97	2	1	3000000001125	I'm having a great day.	0	0
12	14	99	1	0	3000000001125	I am feeling really happy.	0	1
13	15	0	100	3000000001125	I am feeling really sad.	0	1	

Database containing call data, SIHI data, sentiment data, caller and CSR utterances, etc.



Inbound Shipping Management

As a seller of thousands of different specialized car parts, Speedway Motors handles a very large volume of international shipments. Prior to this project, several employees at Speedway Motors had to handle the tracking of international shipments using documents such as invoices and packing lists instead of an organized or technical system. This manual system was inefficient and meant that these highly qualified workers relegated precious hours of work each week to handling inquiries regarding container location and estimated arrival times.

The challenge for the Design Studio team was to create an international inbound shipment dashboard that would allow for the entirety of the previous process to be streamlined and automated. The dashboard that the team has developed allows for data on product orders and associated

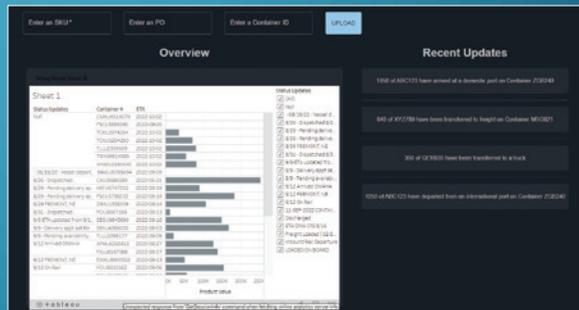
shipping containers to be uploaded to a database. The dashboard then presents the uploaded data in an easily digestible format that is searchable by multiple valuable and relevant fields.

In addition to saving time, the inbound shipping dashboard application developed by the Design Studio team will allow Speedway Motors to have better insight into the shipping status of all moving containers throughout the shipping process. The dashboard will also allow for any internal or external questions regarding item restock timing and status to be answered quickly, easily, and accurately. The Design Studio team is proud to have delivered a product that will save time for valuable Speedway Motors employees and allow Speedway Motors to make more informed decisions regarding international shipments moving forward.

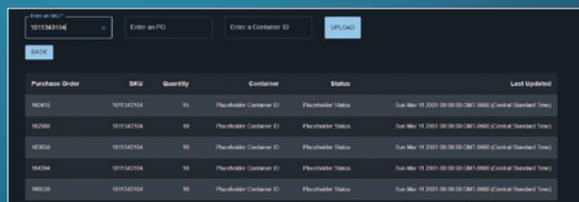
TEAM

Hung Bui
Dylan Chapin
Emma Mirnics

Liam Seper
Nicole Serpico



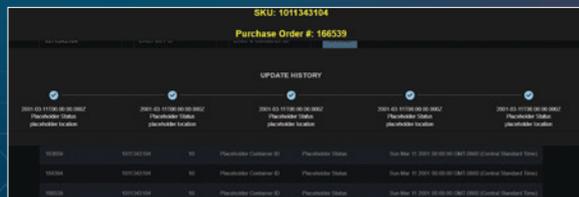
The main page of the inbound shipping management dashboard, including recent updates and visualizations.



A more extensive example of the search results returned by the application.



The search page of the shipping management application, featuring the ability to search by SKU, PO, or Container ID.



The pop-up modal associated with each search result, which includes shipment updates for each container.



Inventory Verification

Spreetail is a full-service e-commerce accelerator that partners with manufacturers who want to grow their brands and e-commerce presence. Inherent in Spreetail's business model is buying and storing its partners' products. To provide value, Spreetail must maintain accurate inventory counts across each of its seven fulfillment centers nationwide.

Currently, Spreetail struggles to maintain accurate inventory records. There are often mismatches between inventory quantities recorded virtually and those physically present in each location. Incorrect data may result in shipping delays, increased out-of-stock rates, or over-stocking of inventory. To minimize inaccuracies, warehouse team members conduct "aisle verification," verifying item counts on every row, aisle, and column within each warehouse every month. However, this process is extremely time-consuming, costing the company up to 3,400 labor hours monthly.

The team sought to streamline Spreetail's inventory audit process by leveraging the company's existing tools. After conducting problem identification and solution ideation, the team worked with Spreetail to transition the company to an inventory audit process called "cycle counting." Companies that have successfully implemented cycle counting have boasted 60-70% faster inventory audits.

The principle of cycle counting is auditing high-value items at an increased frequency and limiting the time spent auditing low-value inventory. To implement this process, the team first designed a new algorithm based on Spreetail's inventory statistics. They then fully redesigned the application used in inventory auditing. The updated application provides each fulfillment center with a daily list of items to review and allows employees to collaboratively conduct inventory audits at more efficient intervals.

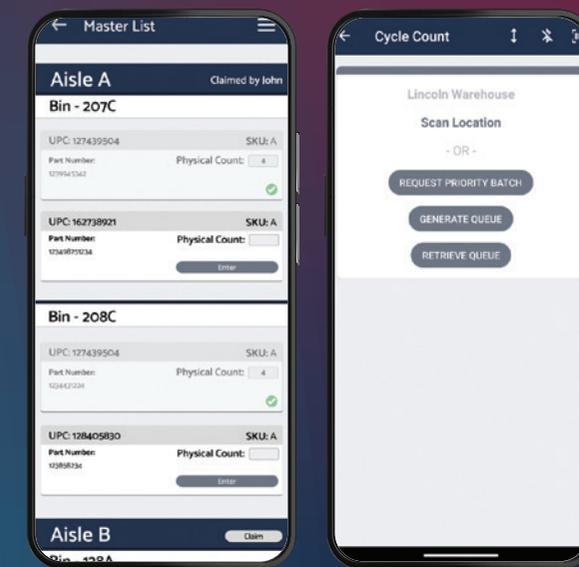
TEAM

Ciara Baumert
Samuel Ingledue
Simreen Kaur

Evan Melchior
Arjun Ramesh
Brysen Reeser



Fulfillment Center Tools logo.



Inventory audit screen displaying items to audit each day, sorted by aisle and bin.

Application homepage where users generate new queues, retrieve existing queues, or use other tools.

UBT Union Bank & Trust

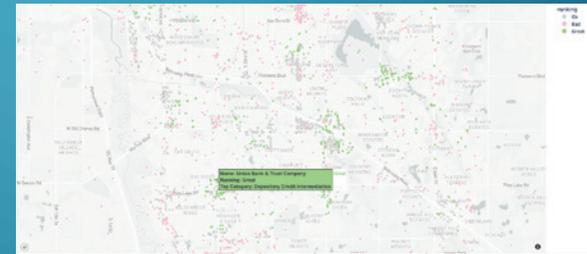
Bank Location Predictor

Union Bank and Trust (UBT) provides banking services to individuals, families, small businesses, and large corporations throughout Nebraska and Kansas City. Across the industry, banks have to carefully evaluate where to open physical locations. UBT key decision-makers must answer several questions: should UBT close a location that is not driving enough deposit growth, should UBT open a new location, and should UBT acquire a bank at an existing location?

The team was challenged with researching how various places (such as competitor banks, restaurants, stores, government buildings, auto shops, etc.) impact branch placement, which is unprecedented in the banking industry. To help UBT key decision-

makers determine optimal bank branch locations, the team researched multiple datasets and tested various machine-learning models. After multiple iterations, the team built a Random Forest machine-learning model using external real estate and FDIC deposit data.

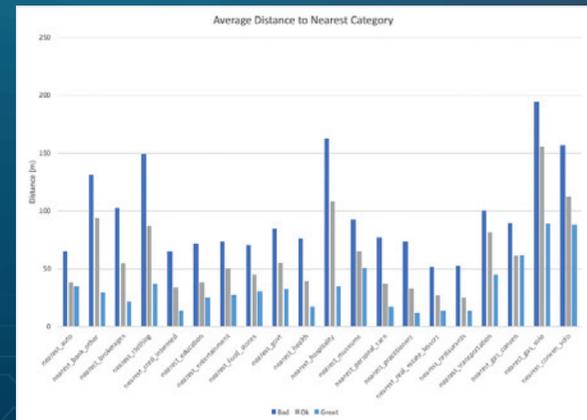
Now, UBT key decision-makers can view the team's generated map of the Lincoln, Omaha, and Kansas City metropolitan areas with specific locations marked as bad, okay, or great potential areas for a bank branch. UBT can also reference an in-depth report, including attempted models, feature engineering iterations, and relevant insights to guide future decisions regarding location management.



Map visualization of existing bank locations categorized as bad, okay, or great locations in Lincoln, NE.



The team's random forest model categorizing banks as bad, okay, or great with an 87% accuracy.



A depiction of how average category distances (from the nearest bank) varied by ranking.

TEAM

Connor Boudreau
Gisele Kamanzi
Lizzy Kenes

Emily Kraai
Cooper Sheets



Beacon

Beacon is a student-led startup dedicated to improving the nation's infrastructure inspection process.

There are 617,000 bridges in the U.S. and the Federal Highway Association requires that each of these bridges is inspected at least once bi-annually. The regulations require a visual inspection among other more technical inspections. Unfortunately, these required bridge inspections are costly, time-intensive, and dangerous. An average bridge inspection can cost several thousand dollars. Additionally, if a major bridge is shut down, there are large costs associated with redirecting traffic. Bridges can take a day or several days to be inspected and often involve closing the bridge. A small bridge could be inspected in a day, but a larger bridge could take several days. Though this may be just

an inconvenience in more rural areas, in a large city, redirecting traffic for even just a few days is a major headache. The bridge inspector job itself is physically demanding and dangerous, as inspectors climb and maneuver under the bridge with the assistance of a harness. Fortunately, by utilizing autonomous drones, infrastructure inspections can become more efficient.

The Beacon team has developed an autonomous drone system capable of navigating between points without GPS access. This system is the first step toward fully automating infrastructure inspections and introducing cost savings, time efficiency, and safety to the process. The system will allow inspectors to use a drone to take the same images of bridge points for precise monitoring each year.

TEAM

Jack Beery
Gabriel Clark
Samuel DeZube

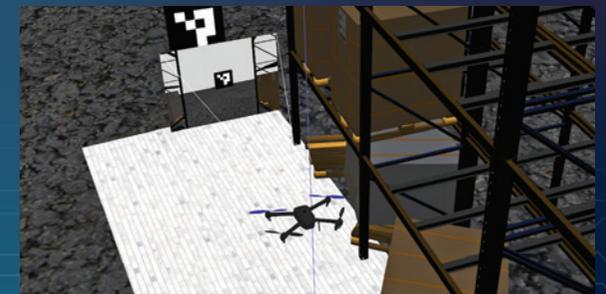
Paul Owens
Maci Wilson



Routine drone flight.



Potential autonomous drone system use case.



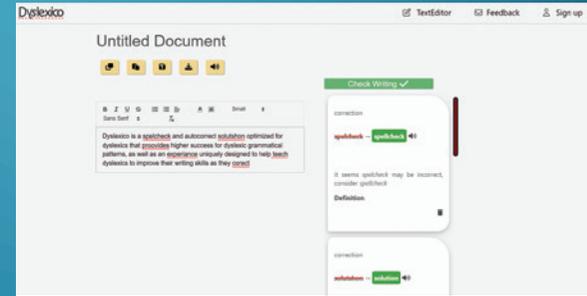
A simulated drone autonomously locks on to a point.

Dyslexico

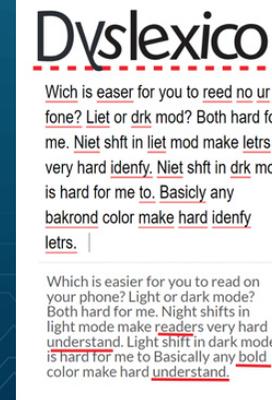
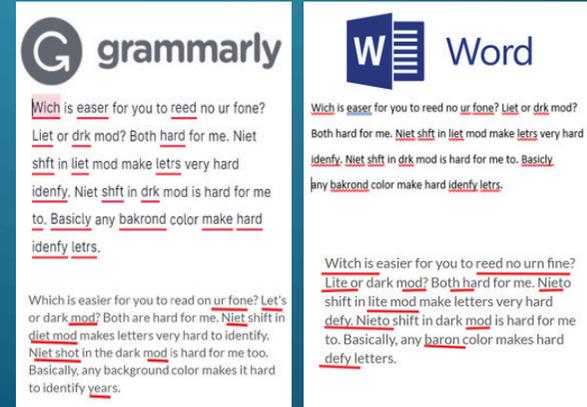
Dyslexico

Dyslexico's purpose is to provide integrated and accurate spelling and grammar corrections for people with Dyslexia. Leveraging machine-learning technology, Dyslexico provides seamless spelling and grammar corrections that are tailored to the Dyslexic mind.

This year, the Dyslexico team built a text editor specifically designed to allow people with dyslexia to succeed. Accessibility tools such as text to voice, and font customization were key features implemented. Additionally, the Dyslexico team created and trained a machine-learning model that provides corrections based on trends characteristic of dyslexic writing.



See Dyslexico in action.



Dyslexico's bias towards action is specifically tuned to the dyslexic experience.

Current educational tooling leaves dyslexic minds behind and scrambling to adapt to software that is not made for them. Every unique mind deserves dignity and tools that help them reach their potential. Through Dyslexico's accessibility tools developed throughout the semester, they have been able to give dyslexic individuals tools to help them thrive.

TEAM

Grace Clausen
Tristan Curd

Bridget Peterkin
Schadrack Shumbusho



Tapp Sports

To stay competitive, the modern baseball coach must record and analyze hundreds of data points per day. A good portion of these data points are user-entered, currently with clipboard, pen, and paper. Inevitably, these papers pile up and coaches get overwhelmed by the amount of data they must understand, visualize, and communicate to their team daily. Tapp Sports was founded at the Raikes School in 2021 to solve this problem by giving coaches the most intuitive tagging tools and data analysis blocks to automate these processes.

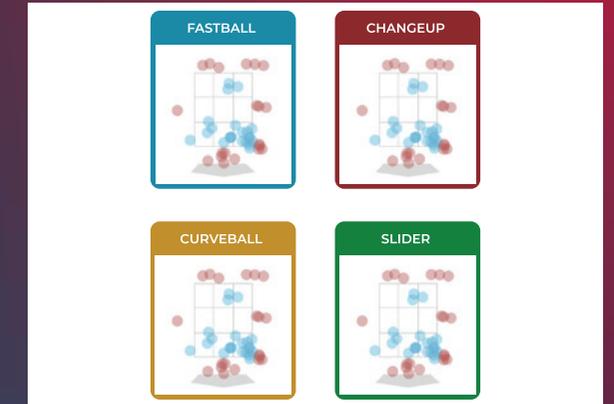
In its second year as a Design Studio startup team, Tapp Sports has continued to grow both its technology offerings and business strategy. Tapp Sports' technological advances include developing a mobile app (now available on the Apple app store), redesigning the

TEAM

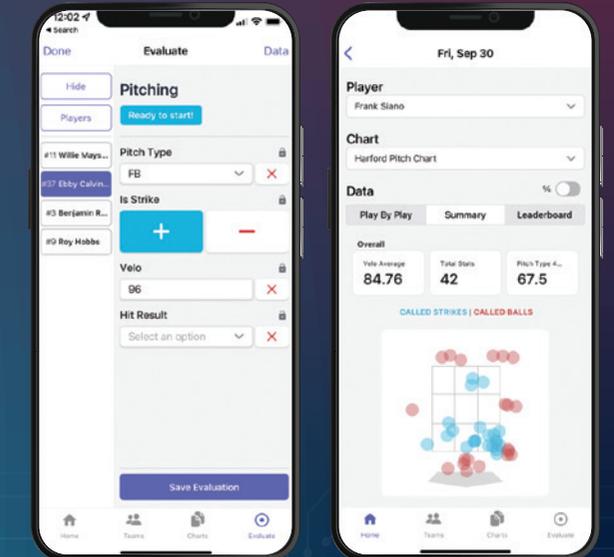
Jayden Boesch
Matthew Hotovy
Michael Kelly

onboarding process to reduce user friction, adding new tracking and analysis tools, fixing bugs to create a more stable and sustainable app, and updating their API to enable integrations with external websites. On the business side of things, the Tapp Sports team developed a media package, sent monthly update emails to build business connections, and explored new markets such as professional baseball and showcase camps. Additionally, the team has started a partnership with Play'N Sports to capitalize on the opportunity presented by the showcase camp market.

The team is excited to enter a new market with the aim of fulfilling its mission to empower coaches to make decisions that enable players to achieve their full potential. For more information, visit tappsports.com.



Example report generated for a showcase event. This report highlights the effectiveness of a pitcher at the camp.



Evaluation screen where coaches evaluate their players.

Session page showing the summary of a player's performance for a given day.

RESEARCH STUDIO

Safety Verification for Autonomous Driving On F1Tenth

In recent years, self-driving automobile technology has seen significant advancements, and it is close to the point where it can take over human driving in a variety of use cases. Unfortunately, this technology has and will continue to have numerous safety concerns that limit its viability within the real world. In order to monitor the safety and accuracy of these systems, various safety verification techniques have been developed, but very few of these technologies have been tested in real-world use cases. These algorithms can struggle in both speed and performance when tested in real-world environments, and many of these algorithms are not yet applicable to put on real self-driving cars.

This project aimed to address this issue by creating a real-world testbed that researchers can use to test and iterate upon new verification

algorithms. Additionally, this project developed a real-world verification technique fast enough to verify likely collisions between vehicles on a small-scale embedded system. The project consisted of the design of a 1/10th scale car with several small-scale self-driving neural networks, the development of a realistic driving simulator, and the implementation of a real-time safety verification algorithm designed to predict future collisions between vehicles.

Using various object detection strategies, this car is able to drive around a sample track environment using only the output of a regular camera. It can avoid obstacles, follow lane lines, and monitor traffic all while providing real-time data on the safety of its decisions.

TEAM

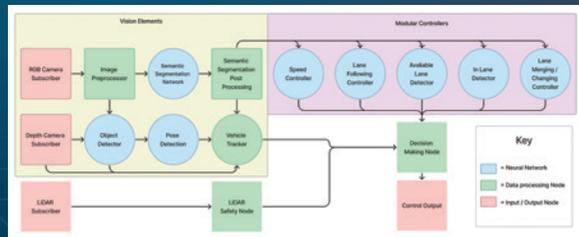
Ryan Brown
Dr. Dung Hoang Tran, Assistant Professor, UNL School of Computing



The physical cars used in the testbed and the two major sensors used in self-driving technology.



A picture of several cars in our simulator that contain realistic driving mechanics.



The control stack used to determine autonomous driving decisions along with all the neural networks that drive it.

RESEARCH STUDIO

FruitPhenoNet: Fruit Detection From Hyperspectral Imagery Using Deep Neural Networks For Temporal Plant Phenotyping Analysis

This research project focused on computer vision applications to plant phenotyping.

Hyperspectral cameras capture images in a broad range of wavelengths at narrow intervals. Hyperspectral images can detect characteristics in plant imagery that are difficult to detect using visible light images. One research objective was to develop a computer vision model that can detect pepper fruits in time-series hyperspectral imagery using deep learning. The research images capture the electromagnetic spectrum at wavelengths between 546 nm and 1700 nm at 4.7 nm wavelength intervals.

A second research goal was to compute fruit phenotypes using the newly created pepper detection model. A plant phenotype is an

observable characteristic resulting from the interaction between a plant's genetic makeup and its environment. The research computed a set of phenotypes based on fruit yield, size, shape, and location. These phenotypes were analyzed as a function of time and treatment (drought-stressed, well-watered).

The dataset developed for this project will be publicly available to spur research advancement through new algorithm development and uniform comparisons among the state-of-the-art methods. The dataset now includes over 500 labeled images from 14 plants of the *Fooled You* jalapeno pepper cultivar. Hyperspectral image analysis research for plant phenotyping is in its infancy, and this project expanded the knowledge base of this emerging field.

TEAM

Charlie Floader
Dr. Ashok Samal - Professor, UNL School of Computing
Dr. Sruti Das Choudhury - Associate Professor,
UNL School of Natural Resources and the School of Computing



Pepper plants moving through imaging chambers at the LemnaTec Scanalyzer 3D High Throughput Plant Phenotyping (HTTP) facility.



A visible light, RGB image of a *Fooled You* jalapeno pepper plant.

The corresponding hyperspectral image of the plant at wavelength 1333 nm.

The Design Studio Team



CHERYL NELSON
Director of Design Studio

With 20+ years of experience directing software and engineering teams for fortune 500 companies, Nelson is passionate about mentoring students in leadership and agile software development.



RACHEL MICHAELA BRADLEY
Design Studio Architecture and Engineering Lead

A senior IT technician-turned-software engineer, Bradley brings over a decade of experience to Design Studio.



DR. ROBERT MACKALSKI
Assistant Professor of Practice,
Academic Lead

A software entrepreneur turned academic, Mackalski teaches marketing courses at the Raikes School.



NANCY HEYNE
Design Studio Program Lead

With twenty years of business experience in public relations and marketing communications, Heyne works with industry partners on projects and coaches teams year-round.



DR. STEVE COOPER
Executive Director of the Raikes School

Previously at Stanford University, Cooper believes in learning by doing and that changing the world in the 21st century starts with understanding business and computer science.



DARIC TESKE
Interim Academic Lead

Teske is a software architect with Buildertrend in Omaha. He is responsible for mentoring students on best practices in software development.



JAKE KOPERSKI
Design Studio Program Lead

Previously a software engineer and startup entrepreneur, Koperski is now creating opportunities for students and mentoring teams on best practices.



DR. JUSTIN FIRESTONE
Assistant Professor of Practice,
Academic Lead

Focused on the intersection of technology, ethics, and law, Firestone teaches software engineering courses for the Raikes School and cyber law at Nebraska Law.



DR. STEPHANIE VALENTINE
Assistant Professor of Practice,
Academic Lead

Teaching software engineering courses at the Raikes School, Valentine works with Design Studio teams on novel interaction design and applied machine learning.



Startup Studio Advisors

These individuals acted as executive sponsors for the teams. They sit in on release meetings and kick off the grading process by giving feedback to faculty.

Team Dyslexico: Mike Cassling, CQuence Health Group

Team Tapp: Ben Williamson, Invest Nebraska

Team Beacon: Pat Kerrigan, The Palm Beach Holding Company, Ltd.



Entrepreneur Panel

Along with the advisors, these volunteers attended two release meetings throughout the year to give direction and guidance to the teams.

- Dr. Lindsay Thomsen
- Neema Bahramzad
- Lizz Whitacre
- Christina Oldfather

Design Studio Coaches

Coaches are industry experts and volunteers who meet with the team weekly and provide mentorship and guidance on best practices.

- Bill Anderson
- Neema Bahramzad
- Todd Bryant
- Paul Cooper
- Nick Ebert
- Andy Giese
- Nick Hershberger
- Rees Klintworth
- Marek Kracl
- Santi Murtagh
- Rob Nickolaus
- John Roby
- Jacob Sanchez
- Ashlyn Slawnyk
- Trevor Slawnyk
- Justin Stark
- Leon Stewart
- Sherry Weber
- Matt Will
- Brian Zimmer

Guest Speakers

- Teresa Friesen, Founder and CEO, SheMate
- Scott Baird, Former COO, Tabs3 Software
- John Bunting, CEO, Beeso Studio
- Jessica Smith, Sr. Application Security Engineer, Block
- Ben Jackson, VP of Product, WP Engine
- Dr. Christopher Bohn, Assistant Director for Capstone, UNL School of Computing
- Brendan Owens, Software Engineer, Layer
- Chad Michel, Sr. Software Architect, Don't Panic Labs



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To learn more about supporting the Jeffrey S. Raikes School of Computer Science and Management, contact Kathy Schubauer, Director of Development
kathy.schubauer@nufoundation.org | 800-432-3216

To learn more about sponsoring a project, volunteering, or joining Design Studio as a student, contact Cheryl Nelson, Director of Design Studio
designstudio@unl.edu

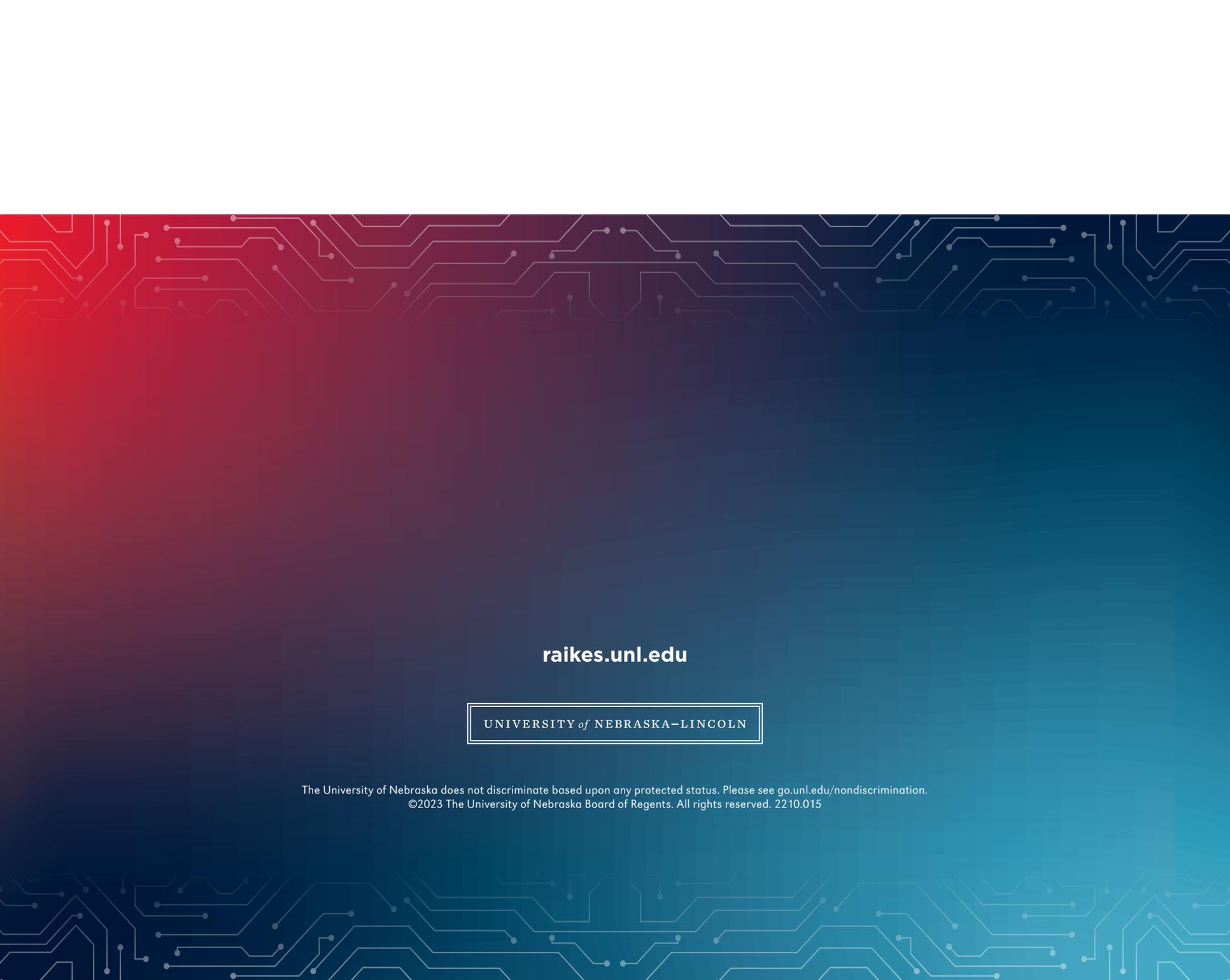
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630 N 14th St. | Kauffman 123 | Lincoln, NE 68588-0690

“
With innovative focus and
continued improvement,
Design Studio is excited and
energized for the future.

”
— Cheryl Nelson, Director of Design Studio —

The background features a circuit board pattern with white lines on a dark blue gradient. The pattern is most prominent at the top and bottom edges, fading into the background in the center. The color gradient transitions from a deep red on the left to a dark blue on the right.

raikes.unl.edu

UNIVERSITY *of* NEBRASKA-LINCOLN

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