Design Studio

2017-2018 Annual Report

Jeffrey S. Raikes School of Computer Science and Management

CONTENTS

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TWO CUTS ABOVE

Design Studio is a key differentiator in capstone education. The Raikes School is a jewel of the University of Nebraska system.

Since its founding in 1999, the Raikes School has strived to be the interdisciplinary jewel of the University of Nebraska system, bringing together management, computer science, innovation, and design like no other undergraduate program. The school exists to solve a problem—how to produce more technological innovation and leadership in our state. Design Studio, the school's junior/senior industry-based capstone experience, remains unmatched in our category of undergraduate education. Our graduates have a two year head start on their careers—two cuts above their peers.

But we can't provide this experience without a wellspring of support. Our industry partners, investing in developing technology leaders here at home. Our volunteer coaches, providing crucial professional mentoring and development (check out the Coach Spotlight on page 8). Our faculty and staff, working every day to make this vision a reality for our students (discover Machine Learning on page 10). Our alumni, providing paths for our students to follow. Our state, for believing in and supporting our mission. And most importantly, our students: *the next generation of leaders in software and technology.*

This year saw 168 students driving 29 projects across 24 different sponsors—flip to the end to see all the ways we crunch the numbers. But really spend your time on the projects themselves. Our top two outstanding projects this year involve geographic information systems (Water for Food—page 19) and 3D materials engineering (NU Sensi-Plate—page 15). Our students are doing amazing things in other areas like health and machine learning (HATCX—page 14), agricultural information technology (Realm Five—page 20), and financial technology (Fiserv—page 25).

But finally, walk away impressed by our students—they are two cuts above.

Mark Antonson
Director of Design Studio

OVERVIEW

Design Studio uses a design-centered process for innovation to give University of Nebraska-Lincoln students studying at the intersection of business and engineering a highly interdisciplinary capstone experience.

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

Students in Design Studio participate in a two-semester industry partner sponsored software development project. Using a release-driven approach to software development which builds on agile Scrum methodologies, students work in a self-organized team to design, develop, and release work product to sponsors three times during each academic semester. Students learn first-hand how to leverage software to solve complex problems by applying knowledge gained in the classroom to the actual practice of working in teams with customers, managing changing requirements, conceptualizing problems, and designing and building robust solutions using software. Students leave Design Studio having gained experience that places them two to three years ahead of peers graduating from college. Faculty support teams with mentorship and instruction focused on design-based approaches to problem solving, software engineering concepts, leadership, communications, and management strategy.

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 understand space needing a specific system, teams in Design Studio are up to the challenge!

Project inquiry begins each April with selection and commitments made in 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 planning. 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, cumulating with the final product delivery in May.

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

Design Studio Process

Start of Project · Release #1 · Release #2 · Release #3 · Release #4 · Release #5 · Release #6 · End of Project

Project Initiation

Project Execution

Design
Accept — Code
Test

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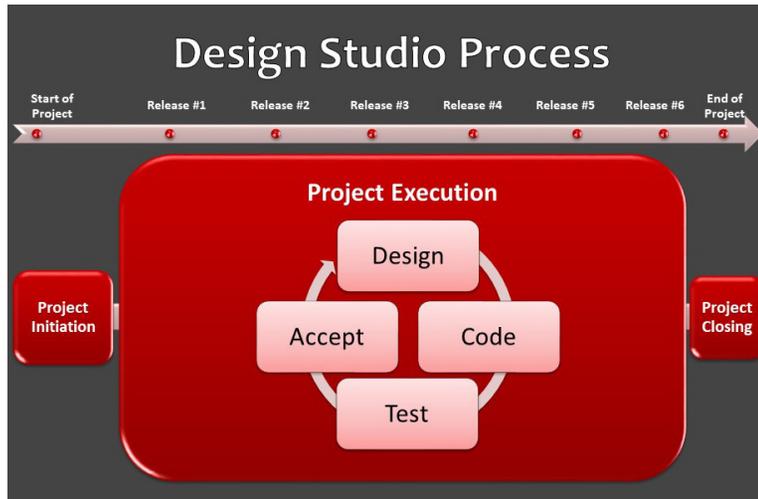
Student teams follow a highly interactive, iterative development framework. Teams focus on execution of the project, releasing versions of the product they are developing six times during the year. This allows partnering organizations multiple opportunities to use, evaluate, and give feedback on what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

Serves as a framework for all Design Studio projects.

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:

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.

Interested in sponsoring a Design Studio project?

Please contact Mark Antonson at
mark.antonson@unl.edu

STAFF UPDATE

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 a combined 22 years of Design Studio experience –keep reading to meet our core staff. Of course four people can't possibly support 168 students in a program like Design Studio –it takes a village of other faculty, staff, and volunteers, so flip to page 31 to see credit where credit is due.

Mark Antonson
Director of Design Studio

Bhuvana Gopal
Assistant Director
of Design Studio

Jeremy Suing
Senior Design Studio
Project Manager

Christy Thomas
Design Studio Project Manager

Over 11 years of product management and software design experience, most recently as a Software Architect, Tech Lead with Fiserv. Graduate of the **Raikes School** and Raikes MBA programs.

Over 12 years of software design, development and implementation experience in various capacities (Senior Software Engineer, Team Lead, Technical Lead, Project Manager) using object-oriented technologies including the .NET full stack and J2EE technologies.

Over 18 years of experience developing and managing software projects in both enterprise and academic settings. Managing projects and operations for Design Studio and Senior Design for over 12 years.

Over 15 years of experience managing software development projects in both enterprise and academic settings.

COACH SPOTLIGHT

✉

Interested in becoming a coach?

Please contact Mark Antonson at mark.antonson@unl.edu

JAKE HEIDELK

Jake Heidelk fondly remembers his time in the Raikes School, though he doesn't have to think back far. He roamed the halls of Kauffman just three years ago. As is the case with every Raikes School student, his experience with Design Studio took the lion's share of his focus during his junior and senior years. The projects seemed daunting at times, but one individual helped him remain upbeat and confident throughout the process: his Design Studio coach.

When Jake was asked if he would be interested in returning to his old stomping grounds as a coach, he didn't hesitate. "I said, 'Yes, absolutely.' I knew that a coach was a very valuable member of the Design Studio team when I was a student, so when the opportunity came up for me to be a coach I knew I had to take it because I wanted to be that same resource for future students," Jake said.

Jake, a Software Engineer at Spreetail, coached a team sponsored by Realm Five, then a fellow tenant at Innovation Campus. That proved to be convenient, as Jake could hop over to the Realm Five office whenever his team met with the client. And while client meetings required the students to tap into their professionalism skills, outside of meetings, Jake's interactions with the team quickly became casual. "The coach is like the team's best friend," he said. His ability to pull from his own experience in Design Studio when offering advice proved to be invaluable and helped him relate to the team on a personal level.

The coach plays an important role in guiding the team in a way few others could. The role combines enough technical expertise and real world experience to aide in solving problems, and enough separation from the project to serve as a trusted mentor. Unlike the faculty and project sponsor, the coach has no input in the students' end-of-year evaluations. Jake said, "The students can feel comfortable coming to the coach. They can come with concerns or with questions without any fear of it harming their grade."

It's similar to mentoring a new employee in an unfamiliar workplace. New employees need someone to take them under their wing — to help them learn the nuanced language and politics of the office. Someone who can sympathize to stressful situations as they arise and give reassurance that everything will be okay. And someone who can give the sage advice that only experience can bring. That's the coach.

Of course, it isn't just the students that learn from the experience. "These students are so smart and technology moves so fast and they pick up on things so quickly that even I as a fresh graduate get left in the dust sometimes," Jake said. "If there's one thing I've learned from being a coach, it's that I need to step my game up, because these students are gonna come and eat my lunch."

Design Studio is an opportunity second-to-none in preparing the next generation of programmers, developers, and business professionals. And a critical component in rounding out the students' education is the wisdom offered by Design Studio coaches. If you are interested in being a vital resource to a Design Student team, please contact Mark Antonson at **mark.antonson@unl.edu.**

MACHINE LEARNING

New Data and Models Curriculum

One of the most exciting developments at the school this year is the rollout of our new *Data and Models* three course sequence. The objective is to present an integrated foundation for methods supporting designs, decisions, and strategies under uncertainty in situations where data exists, or can be gathered or developed. Several of the Design Studio projects this year benefited from our new curriculum, and we look forward to pursing increasingly high value Design Studio projects that leverage the methods and insights gained from these courses.

Last fall we introduced *Data and Models I: Foundations of Data Analytics* which provides credit for introductory statistics for all majors. It was presented as a foundation for subsequent topics that included machine learning, randomness, time dependence, and simulation. The course emphasized programming, simulating, and visualizing the principles of probability and statistical inference. The first few problem sets,

for example, included a Monte Carlo simulation, a Markov model, a random walk, simulation of the Monte Hall problem and Bayesian learning.

This current spring semester those students are taking the second course in the sequence, *Data and Models II: Foundations of Data Science*, which provides a strong foundation, as well as problem solving skills in data science and machine learning. The methods of supervised and unsupervised, as well as classification and regression learning are covered. The faculty were impressed to see sophomores doing neural network predictions in the first problem set and participate in a Kaggle competition in the third problem set! The latter weeks of the course allow the students to pursue their own specializations such as big data, cloud deployment, or tools such as Tensor Flow and Tableau.

The third course, *Data and Models III: Foundations*

of Management Science, will be offered for the first time next year. This course will address time dependent and sequential methods, optimization, and simulations including Monte Carlo and agent based models. Since this course provides students with required credits for business, the application focus will include forecasting, scheduling, resource allocation, and simulation of business operations and human-based systems including organizations and markets.

These data and models courses are expected to have a positive impact on the quality and mix of Design Studio projects in the coming year. The courses themselves have certainly been influenced by the data science requirements of our Design Studio projects in recent years.

DR. DAVID KECK
PROFESSOR OF PRACTICE, RAIKES SCHOOL

PROJECTS

Buckle

INVENTORY REDISTRIBUTION OPTIMIZATION
Sponsor: The Buckle

Offering a unique mix of high-quality, on-trend apparel, accessories, and footwear, Buckle caters to fashion-conscious young men and women. Known as a denim destination, each store carries a wide selection of fits, styles, and finishes from leading denim brands, including the Company's exclusive brand, BKE. Headquartered in Kearney, Nebraska, Buckle currently operates 456 retail stores in 43 states.

The Company's marketing and merchandising strategy is designed to create customer loyalty by offering a wide selection of key brand name and private label merchandise and providing a broad range of value-added services. As part of this strategy, Buckle keeps its inventory low in each store to emphasize the newness and exclusivity of the product and drive fast inventory turn times. Buckle needs to optimize its inventory in each store and replenish inventory in the stores that are turning it quickly by transferring the inventory that is not turning in another store. Ideally, by keeping the inventory turning at the original price, Buckle can reduce markdowns, maintaining original margins, quick sell-throughs and reduce the cost to liquidate dead inventory.

Before the project, the redistribution process was mostly manual. A team of about twenty analysts used internal reporting to analyze what product needed to move. Their goal was and still is to move product from where it isn't selling to where it will sell. Their reports provided several different data points of their current inventory to assist in making their decisions. Along with the selling information, they relied on intuition and experience.

Buckle wanted a way to simplify the manual process for its analysts and minimize the errors occurring with the outdated system. As a solution, the team designed an algorithm to take into account which data metrics Buckle's analysts were using to determine which stores to send product to and which to take product from. Then the team created a web interface to allow the analysts to select data variables as inputs to run the algorithm, analyze the results and adjust the results in a table format. This model minimizes the amount of manual processes and decisions that the analysts need to make before pulling items from stores, thus significantly reducing the time and manpower to complete the inventory transfers.

NET GRANTS MANAGEMENT

Sponsor: Nebraska Environmental Trust

This project replaces the core business application for managing grants and creates a new web tool to allow citizens to submit their grant applications via the web. The current Microsoft Access Database entered manually will be migrated into a new SQL Database that is populated from the new Web Application. This will hold all grant application information as well as track when the application is submitted or reopened for further editing.

The solution to this project was to create an MVC web application in C#. This application allows for all general user login functionality in an easy and safe manner. The user is then able to manage, create, edit, delete, copy or print off a new grant application. The seamless integration into the SQL database will greatly simplify the application process and how it is managed.

HATCX | THRIVE

Sponsor: HATCX

HATCX | thrive is a destination mobile application that provides users a snapshot of their health in one location. HATCX | thrive measures the consumer's overall health age in an interactive, easy way that allows them to see how their behavior impacts their overall health. The app will allow users to measure how healthy they are, access their medical history, shop for and schedule medical services, pay medical bills, engage with other users and friends, and see all their health information in one spot. One of the key components of HATCX | thrive is the HAA, or Health Age Algorithm. This allows users to estimate their health age and will offer actionable insights for users to improve their overall health.

The Design Studio team was tasked with focusing on sleep, diet, and exercise to create the initial HAA, but not to limit the algorithm to these categories. The app the team built currently gives users a portal to connect their wearable device data and input additional information about their health to acquire their overall health age, calculated by querying the machine learning model. The current model was built by performing machine learning on the publicly available and extensive NHANES dataset. In the future, HATCX will be expanding the HAA categories to include physical environment, medical history, genetics, and cognitive behavior.

The team incorporated the HAA into a mobile app that is on the iOS platform and that will become the basis of HATCX | thrive.

SENSI-PLATE

Sponsor: UNL Sensi-Plate

The purpose of the NU Sensi-Plate project is to design and implement a system that provides the ability for researchers to electronically measure the food intake of children in a feasible and objective way. The NU Sensi-Plate measures the amount of food consumed by children and communicates this data to parents, childcare providers, and researchers to determine if a child is receiving the recommended and adequate nutrition from each food group (fruits, vegetables, whole grain, dairy, and protein). The Design Studio team's solution to this project was to design and print a 3D prototype of the plate. This design represents the food group recommendations from USDA's My Plate. The NU Sensi-Plate measures the weight of each food group consumed by the child and communicates this data to the cloud, which then retrieves the nutritional content received from each food group from a nutrition API. Researchers are then able to view this data and assess the nutrition each child is receiving for each meal.
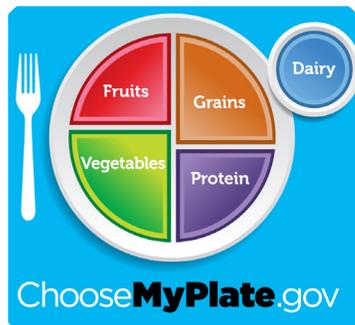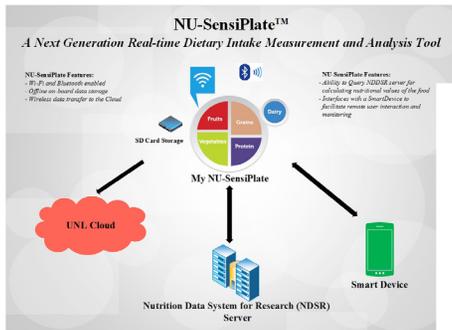
MOBILE-BASED FOOD RECOGINITION SYSTEM

Sponsor: UNL Computer Science and Engineering

The goal of this project is to build a cross-platform application that will promote a healthy lifestyle and decrease obesity rates across the world by allowing users to easily track their meals and activity using computer vision and APIs from popular activity trackers. This application will also allow the user to track their fast food consumption by using GPS technology to recognize the restaurant locations and either suggest a menu item that best fits the user's diet or advice against consuming fast food.

The Design Studio team is utilizing a metabolic model that the sponsor provided them to provide the user with more useful information. We also have a database built to store restaurant menus to use in the application's GPS (location) based recommendations. The team is using TensorFlow for picture recognition and have a dataset that they have been working on improving to increase the accuracy of their predictions.
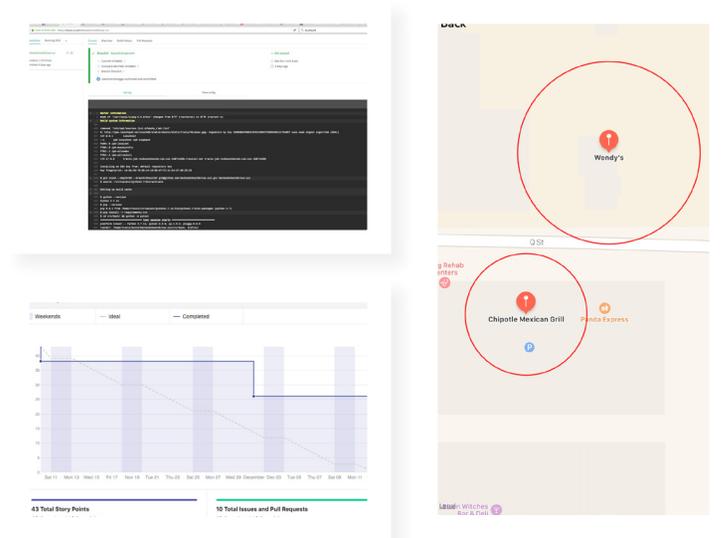
MUTUAL FUND SHARE CLASS CONVERSIONS

Sponsor: TD Ameritrade

The Design Studio team was tasked with rethinking how TD associates performed inquiries of mutual fund share class conversions. The initial process required the use of several systems and interfaces, and featured potentially high-risk and time-consuming tasks such as visual checks of named funds. With thousands of conversions occurring every day, a great deal of financial risk rests on TD associates performing these operations. The complexity of the inquiry system makes it difficult to train or cross-train associates, and slows them down in their day-to-day work.

As a solution, the Design Studio team strove to automate some of the most time-intensive parts of the inquiry process. The team created a web application for analysts to use for the beginning stages of the inquiry process, which allows them to drop a case file into the application and perform preliminary validation checks. This eliminates the risky visual checks for associates, and sorts checked cases into categories based on if they can proceed in the process or not. The application also reduces the need for multiple interfaces and scripts to retrieve validation information. The work of the Design Studio team will be used and expanded upon by TD associates following project completion.
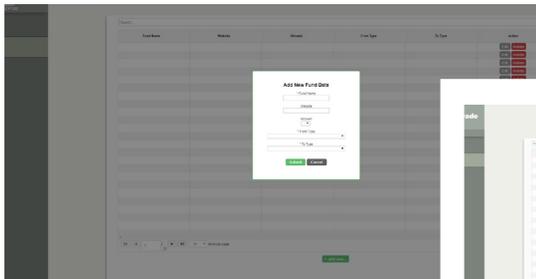
VIRTUAL TRAINING SYSTEM (VTS) FOR MEAT CUTTING

Sponsor: UNL Animal Science

UNL Animal Science is composing a virtual reality educational tool. Throughout the duration of the project, the Design Studio team used Unity, SteamVR, the Vive, Blender, MeshMixer, Visual Studio, and other programs. This tool will help users identify different types and the quality of meat by educating and quizzing the user on various meats in an immersive virtual reality environment. The team spent a large portion of the semester learning 3D modeling techniques, involving taking thousands of pictures of meat on Innovation Campus. Once complete, this learning tutorial has the potential to change the meat industry.
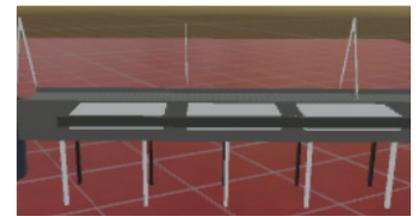
NEBRASKA VEHICLE CRASH DATA ANALYSIS CUBE

Sponsor: Nebraska Department of Transportation

This project provided the Nebraska Department of Transportation with an SSIS package and an Analysis Cube. The SSIS package pulls from a database populated by the current HLA software and places that data in a new database with a layout that can be used by the Cube. The Analysis Cube can be connected to front end applications such as Excel, SSRS, and Power BI to replicate the HLA reports and display the crash data in a user-friendly manner. That data can also be arranged, sorted, and filtered by the front end applications. Providing this to the Department of Transportation will allow them to view

and create reports quickly and in a way that is easily reproducible or automated. The Cube is currently only available internally to Nebraska State government users. In the future it may be used to provide present crash statistics daily to a public portal.

UNMANNED AERIAL SYSTEMS FOR PRESCRIBED FIRES

Sponsor: UNL Computer Science and Engineering

The goal is to equip 50-100 vehicles (ground and aerial) and people with a small device that can gather location, temperature, carbon dioxide, and other environment information, and be resistant to temperatures in the vicinity of fire. The information gathered by these devices should be easily collected and integrated into a map (perhaps integrating it with an existing GIS system) to show, among other things, how personnel and resources move around a fire.
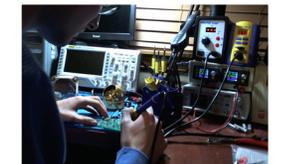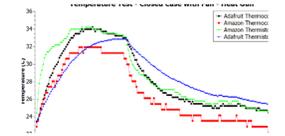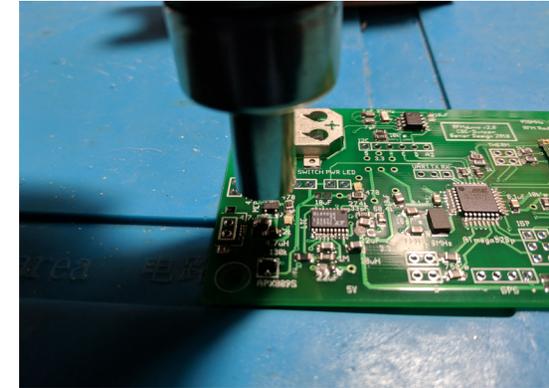
AD HOC REPORTING TOOL

Sponsor: WEX Health

WEX Health provides the leading billing and payment platforms for employers and administrators. With the amount of data and transactions taking place in these platforms, reporting and tracking is a key element to WEX Health's partners and consumers. Both platforms offer a set of Standard Business and Standard Accounting reports. These reports are used daily by partners and consumers, but often additional information is needed, or even a whole new report is required. This project was proposed to alleviate those issues and provide the required Ad Hoc Reporting functionality to those partners.

The Design Studio team was tasked with solving this issue by first researching a possible Business Intelligence solution and then using the chosen BI solution to showcase the capabilities of the BI solution. The team presented five possible BI solutions, and WEX Health decided that Dundas BI was the solution that best met the requirements and also provided the most Ad Hoc Reporting functionality. The

team then set out to recreate the existing reports already provided by WEX Health within the new BI solution.

In addition, they created a demo environment to prototype the embedding and Ad Hoc Reporting capabilities. With a final implementation in future, WEX Health's partners and consumers will be able to view and use the existing reports, and also customize the existing reports and create new reports all within WEX Health's portal.

STUDENT MANAGEMENT SYSTEM

Sponsor: Westside Community Schools

The Student Management System project for Westside Community Schools is in its fourth year as a Design Studio Project and its second year as a live production system.

In previous years, teams have focused on developing the core functionality of the system to prepare it for users. This year, the team focused on making Quality of Life adjustments for the major features already developed. Several of the changes revolved around allowing the administrators of the site more access to data. Previously, administrators had to individually "graduate" students as they left the school. Now, administrators are able to view all students who are eligible to graduate at the end of a semester and graduate the students collectively. Additionally, teachers struggled with discrepancies between paper forms and their respective online counterparts. This led to a reorganization of the "Class" page for teachers, as well as the ability to print schedules for individual classes. Another change devel-

oped by the team was the ability to display decimal mods and decimal credits without negatively affecting the scheduling algorithm. The team also added the ability for schedules generated in the old system to be imported into the new system. This serves as a temporary solution while the scheduling algorithm is being created.

A final area that the team focused on was security. During development, the team discovered that student and teacher photos were linked to accounts using a simple identifier that was easily deduced. This would enable students to download the photos of other students and create counterfeit identification. The team changed the way photos are used on profile pages to ensure the privacy of an individual's photo. This discovery led to the team ensuring that students were not able to navigate to pages that they did not have permission to view, including other students' private information and class schedule.

ONLINE AGRICULTURAL DATA MANAGEMENT SYSTEM
Sponsor: Water for Food

Field-level data collection in agriculture has grown enormously during the last few years. Data is collected from farmer-produced surveys, field-level sensor networks, remote sensing, and other public and private sources. Such data has the potential to revolutionize our understanding of agricultural production and the food-energy-water nexus. However, primarily due to concerns over privacy and difficulties with data standardization, data can be difficult to fully utilize. This affects agricultural producers who produce data, resource management agencies that rely on data to achieve regulatory goals, and researchers working within the food-energy-water nexus.

The Design Studio team worked to create a maintainable, spatially oriented database and analytic tools to help agricultural producers, Natural Resource Managers, and academic researchers better compare their data to relevant data sets, promoting more sustainable agriculture.

This website offers NRD users and producers the ability to view their fields on an interactive map and compare their fields to other fields with identical climate and soil types. The NRD managers are additionally able to view and query heat maps of the users within their district, import and edit their producer's data, and generate reports on each of their producer's resource usage. The goal of this benchmarking is to help inform producers on how to begin making wiser decisions with their various field inputs and give the Natural Resource Managers better information to set these usage standards for the producers. By doing so, the system will help producers remain good stewards of the land and increase long-term sustainability.
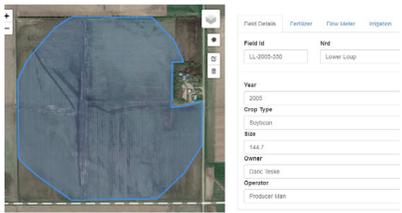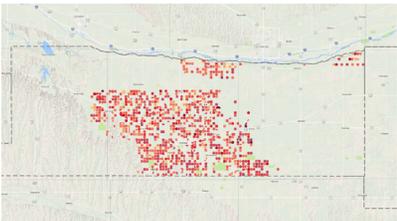
VENDOR VAULT
Sponsor: Spreetail

The online shopping process is designed for convenience and ease of use. However, there's a lot of unseen work that makes this experience possible. Spreetail works relentlessly to ensure their customers have a great experience when they purchase products in marketplaces such as Amazon, Walmart, Jet, Ebay, and VMInnovations.com. To purchase and sell products on these channels, Spreetail team members must maintain constant contact with their vendors via email. With an anticipated $400 million in sales in 2018, this system of communication has proven to be extremely inefficient for such a rapidly-growing company.

The Design Studio team was tasked with building a portal to better facilitate interactions and improve vendor relationships. After a month of user interviews and ideation workshops with Spreetail employees, the team finalized the basic concept for Vendor Vault. Once a vendor expresses interest in selling with Spreetail (VMInnovations), an account manager will create an account for them on Vendor Vault. Upon logging in the first time, the vendor is prompted to enter more detailed information about their company and contacts. They then can upload product information to be listed on VMInnovations.com, add brand information, and view purchase orders from Spreetail. In addition to simply viewing these orders, the vendor will be able to either approve or deny new orders if any information is unexpected or incorrect. Vendor Vault is integrated with other internal Spreetail applications to ensure information stays up to date.
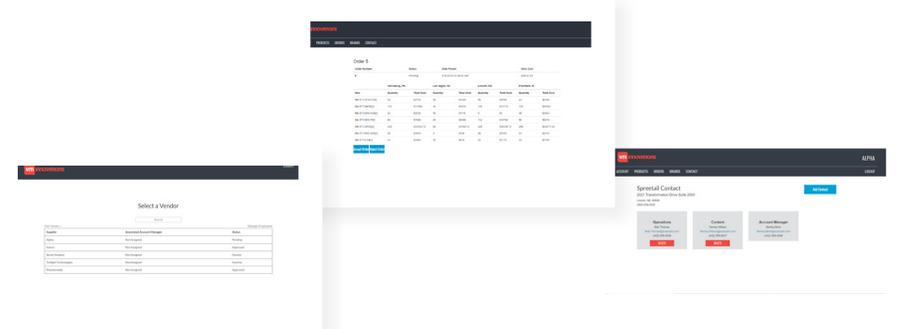
TEAMMATES MESSENGER

Sponsor: Teammates Mentoring of Lincoln

With over 1,200 matches, communication is an integral part of the TeamMates Mentoring program. However, current methods of communication between mentors and students are limited to unmonitored personal phone/email conversations and weekly face-to-face meetings. Meeting times often change and need to be rescheduled, but there is currently no easy way rescheduling a meeting while also informing TeamMates administration of the change.

To solve this, the Design Studio team created TeamMates messenger (TM messenger), a private and monitored communication system between students and mentors. The application is served online so users can use the app on their iPhone, Android phone, laptop, or tablet. TM messenger includes a messaging platform as well as a meeting platform that sends push notifications to the user's email or phone. Meeting requests are sent to administrators for approval, and the use of analytics allows administrators to identify risk areas between mentors and students. Both meetings and messages are supervised by an admin, which ensures the safety of both students and mentors and allows for an overall better match experience.
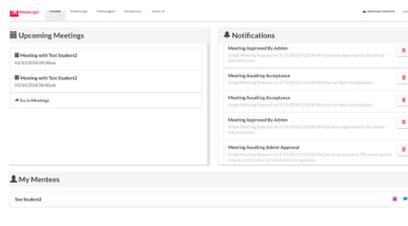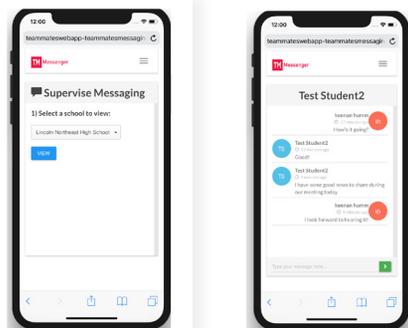
OPERATIONAL TRACKING

Sponsor: Realm Five

Currently, there are complex hardware and software systems that provide extremely accurate data to describe planting, growing, and harvesting operations. However, these solutions are very expensive and only capture about 10-20% of farm operations. The remaining 80% of supporting operations are captured manually through time cards or physical data entry. These manual methods have varying accuracy and often fail to accurately represent labor and equipment expenses.

This project aims to address these problems by providing automated, accurate operational and cost analytics to help management make informed decisions. The Design Studio team's solution consists of two main components that create a back end framework to support Realm Five's Operational Tracking system: a data ingestion service and a data analytics backend with an API. The data ingestion service focuses on taking incoming location data from beacons, storing the data, and processing the raw data into usable models. Once the data is in the operational tracking system, an analytics API allows users and other services to interact with the data and perform a variety of cost and operational analytics, providing information regarding farm operation metrics and costs of different equipment, operations, and fields.

On top of these services, the system scales well with large quantities of data, satisfying another goal of managing big data and monitoring telemetry metrics.
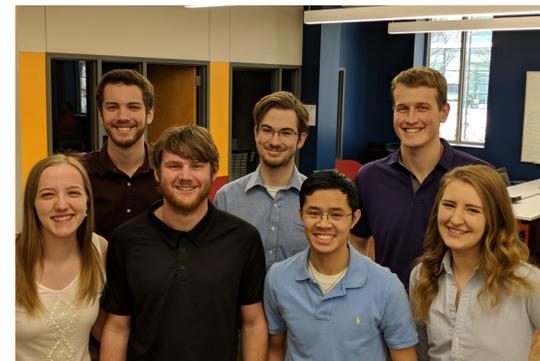
MARKET CREATOR TOOL

Sponsor: NRC Health

NRC Health helps healthcare organizations better understand the people they care for and design experiences that inspire loyalty. Its Market Insights solution promotes this by providing a BI platform designed to help understand wants, needs, attitudes, and opinions of the populations these organizations serve while boosting the effectiveness of their marketing programs.

One of the manual workflows of the platform today is the client custom market creation process. Clients define custom markets across the country to put a lens on the NRC Health data. The goal of this project was to build a market creator tool within the Market Insights solution that allows both clients and NRC employees to more easily conduct this process.

The Design Studio team created a user-friendly, client-facing tool that will allow healthcare organizations and NRC employees to define and visualize custom markets, while being able to view all previously created markets. The tool will allow a user to define these markets through a map interface by clicking or lasso-selecting geographical areas. The tool prominently displays a filterable list of selected areas and a data error range so the user will know if the market's data will be representative of that market. Filtering options, a zip code uploader, and an export option will allow clients and employees to best define their markets. Once a custom market is created, account managers will be able to view pending markets through the tool and approve them.

This tool has multi-faceted benefits for NRC Health. Clients will quickly be able to define geographic markets and see historical response numbers. Internally, NRC Health will be able to become much more efficient from a service and operations standpoint.
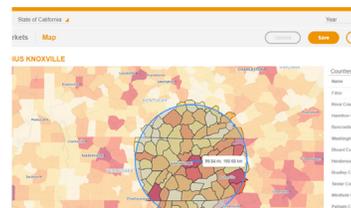
4U, FOUR YEAR ACADEMIC SUCCESS PLANNER

Sponsor: Nelnet

Through primary research that consisted of surveys, individual interviews, and prototype demos, the Design Studio team discovered that one of the biggest problems that UNL is facing is decreasing retention and graduation rates. After follow-up interviews and more research into the issue, the team found the solution to this problem is an interactive scheduling web app.

This application includes a more efficient class planner, the ability to speak with advisors via chat windows, and an easy to understand roadmap of the student's graduation path. As the application, 4U, is launched, more features will be added based on students' feedback. This project was created using Nebraska's data, but the design allows for easy adaption for other colleges and universities. The hope is to integrate 4U with the University's current scheduling software, PeopleSoft, for easy implementation.
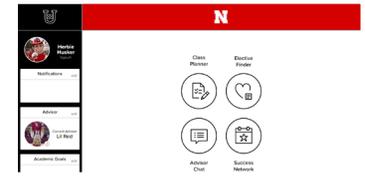
FLY ON THE WALL FITNESS DATA COLLECTION APP

Sponsor: Mutual of Omaha

The Mutual of Omaha Fitness Data Collection App project is a web application that allows users to share their fitness wearable data with Mutual of Omaha and other approved vendors. The app is targeted to seniors, which will help Mutual of Omaha collect data for future insurance development.

Because the website is client-facing, the front end design is a particularly important element. The Design Studio team designed the user interface to be easy to use and understand, with an emphasis on accessibility to seniors. The UI incorporates large text, big buttons, and simple graphics to help older adults navigate the website with ease. Developed on the ASP. NET framework, Fly on the Wall supports Fitbit, Apple Watch, and Garmin wearables. The project also includes an iOS app for Apple Watch integration, an API to allow Mutual of Omaha to share aggregate user data with vendors, and a data viewer on the website which lets users view their fitness data and compare themselves with other users. After a one-time authentication, users don't have to interact with the app at all except to check their fitness progress. The app runs a background process that periodically fetches data from all associated devices without user interaction, making the solution as seamless as possible.

NEBRASKA TRANSPORTATION INFORMATION PORTAL

Sponsor: Nebraska Department of Transportation

The Nebraska Department of Transportation (NDOT), has records of all reported motor vehicle crashes dating back to 1988. Prior to this project, NDOT generated maps by hand-plotting latitude and longitude coordinates, a lengthy and expensive process. The goal of this project is to make this process faster and more dynamic via a web-based, user-friendly application. The Nebraska Transportation Information Portal (NTIP) takes in search constraints such as a date range, highway number, crash severity, or a variety of other constraints and returns a color coded map back to the user. The map plots each incident based on latitude and longitude and ties additional information to each point, such as crash severity and conditions in which the incident occurred. The user also has access to a variety of tools on the map page with which he/she can change map layers, generate an Excel spreadsheet report, or further refine the search by crash properties or geographic area.
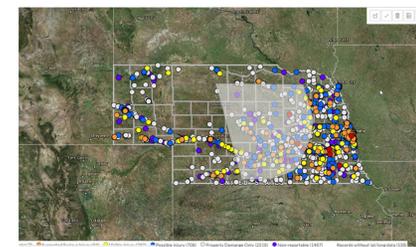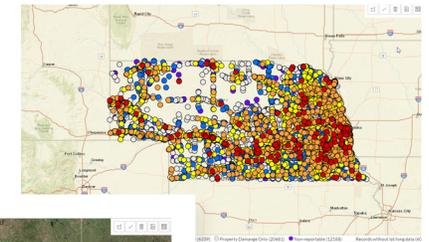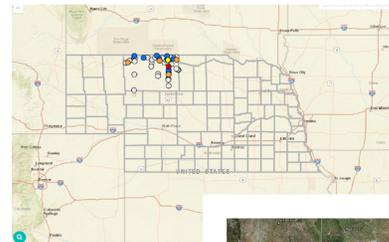
REPORT GROUPS

Sponsor: Microsoft Dynamics

Microsoft Dynamics 365 is an Enterprise Resource Planning (ERP) system used by mid-sized companies to manage, store, process, and report on company data and transactions. Microsoft was looking to develop a system for Dynamics users that would allow them to generate narrative financial presentations to quickly and effectively tell a story using their financial data. These presentations will be produced using Microsoft Sway, an online presentation platform. The final product will be used to further develop this exciting addition to the Dynamics environment.

The team's solution is a workspace within the Dynamics system that users are familiar with. The workspace functions as a presentation-building wizard. Users select the range of data they want to pull from their company's system, the types of analytics they would like to see performed, and some personalization options. They can very quickly produce a professional, dynamic presentation in Microsoft Sway. The system pulls data from the user's company database, performs dynamic analytics, presents these metrics in interesting visual ways, and returns a presentation to the user. The solution balances the complexity of these high-level analytics and the control that the user wants over their final product.

STANDARD RESPONSE PROTOCOL SYSTEM

Sponsor: Lincoln Public Schools

This project is a mobile application that enables and empowers school faculty to immediately alert all staff that a threat exists on their campus so they can respond with the appropriate actions in the Standard Response Protocol. Currently, the process for alerting staff of an emergency relies on traditional announcements over an intercom system or use of two-way radios assigned to selected staff. This application will make notifications to staff more timely and available to a greater audience.The app was made using Xamarin for Visual Studio on Mac OSX. The team used the MVVM pattern for the project. A user can initiate a protocol and that sends notifications to anyone else subscribed to that school or currently located in the school. In protocol, users can message updates about what is currently happening and how they are responding. Once the situation has been cleared, a user can deactivate the protocol.
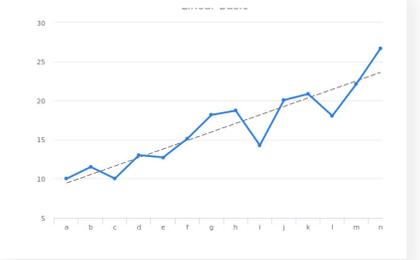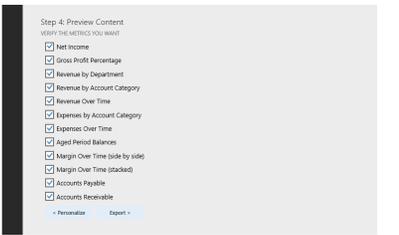
ERUDITE FIRST STEPS TO READING FLUENCY

Sponsor: UNL Erudite Digital Learning Lab

Providing varying levels of personalized practice necessary for students to achieve automaticity of letter names, letter sounds, and sight words represents one of the greatest challenges facing kindergarten teachers. This project was to update a digital game that kindergarten teachers can use to meet this challenge.

In order to accomplish this, the game engine Unity was used to create a webGL game hosted on a custom website. The majority of the website will be used by teachers and parents in order to access statistics on students' performance and also to create student accounts. The home screen, which displays the game, will be the only part of the website accessible to children. The game itself is organized into 3 lobbies (representing letter names, letter sounds, and sight words) with each lobby containing 3-4 blocks (consisting of a manageable subset of letter names, letter sounds, or sight words to practice). The game was changed to allow access to all blocks and all lobbies from the start, and the placement test were removed and replaced with a preview of the letters/words so that the students can review, letters/words they don't know well before trying the game again. Inside each of the blocks are three engaging games that help the user to practice and develop automaticity.

The games were updated to allow different students to play for different amounts of time and to play against different fluency speeds.

ICE HOCKEY

Sponsor: Hudl

Ice Hockey is an underserved market for Hudl, a sport that still managed to draw 2,500 teams to the platform without a sport-specific product. Hudl tasked the Design Studio team with identifying if the firm could win the U.S. hockey market, and then following through with a product to do just that. To achieve this strategy, the Design Studio team developed a dedicated tagging application for ice hockey teams on the latest version of Hudl, allowing coaches to break down game action in their film. In addition to post-game breakdown tagging, coaches are able to analyze statistical and box score reports for individual games or entire seasons—all linked back to the exact moments in video. Hudl's new ice hockey product assists ice hockey athletes and coaches by providing analytical tools that add context and meaning to every moment in their game.
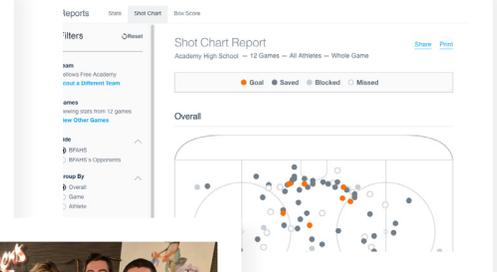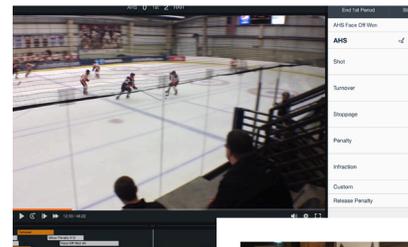
AGPOCALYPSE 2050

Sponsor: UNL INFEWS Game

By the year 2050, the world population will surpass nine billion. In order to keep up with increasing demand for food, sustainable farming practices will become paramount. The INFEWS (Innovations in the Food-Energy-Water System Nexus) aims to combine knowledge from multiple fields to find optimum farming strategies for the years to come by exploring the complex relationships between grain, cattle, and ethanol production; limited supplies of water and energy; climate change; and the economy.

Funded by the National Science Foundation, INFEWS and Design Studio are creating a simulation farming game called Agpocalypse 2050 that will be used in conjunction with 4H and college courses that educate student on these nexus relationships. Players in Agpocalypse 2050 will make farming decisions about which crops to plant, where to plant them, how much to irrigate, what chemicals and fertilizers to apply, how much to sell, how much to process into ethanol, how much to use as cattle feed, which cattle to raise, etc. When complete and used in a classroom setting, each student will be able make independent decisions affecting market prices and the climate that will in turn affect their peers.

Agpocalypse 2050 is being developed primarily in Unity, with C# providing game logic, with the ultimate goal of deploying to Windows, Mac, iOS, and Android devices. In order to reduce the processing power needed in user devices, the complex modeling simulations are handled by a central simulation server with communication to and from client games in JSON.

HAVING A CONVERSATION WITH YOUR DATA

Sponsor: Fiserv

Executives of financial institutions are consistently seeking information about the financial health of their institution and their customer base. Much of this information is delivered via pre-defined reports, client-defined queries and reports, and interactive dashboards. This project's goal is to explore the possibility of being able to access and interact with this data using conversational voice commands.

The prototype is a JavaScript Universal Windows Application, which can be used on any Windows machine. This application integrates the power of voice commands through Microsoft's Cortana with interactive data from Microsoft Power BI reports. Users of the application can interact with reports by activating Cortana and saying "Hey Fin..." followed by their command. The application supports viewing reports, drilling down on data, and performing functions on the reports (such as printing). All of the functionality that can be performed with these voice commands can also be done manually.
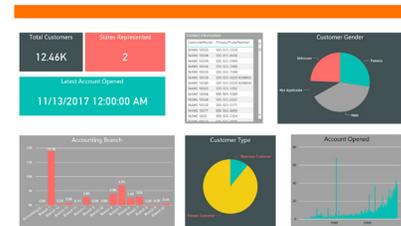
OPSTATS MODERNIZATION

Sponsor: CSG International

Monitoring and alerting are key components in running large, complex systems. Therefore, it is essential for a company to have the ability to be able to continually view events in its systems and act on issues quickly to restore service to users in a timely manner.

To solve this problem, CSG International created its OpStats platform, which provided users with various visualizations and insights into CSG International's systems and their performances. Following the success of OpStats, CSG International developed their modern system, StatHub Portal, to replace OpStats. StatHub Portal processes hundreds of millions of records per day and provides visualizations in a more modern manner compared to OpStats. Gradually, users began to migrate to StatHub Portal as reports and visualizations in OpStats were ported over, but some visualizations remained OpStats-exclusive, preventing total deprecation of the older system. The OpStats

Modernization project aimed to create a series of new data visualizations and reports to provide better visibility into system performance in StatHub UI, the next generation of the StatHub platform. These visualizations and reports display metrics on information such as detailed logs, volume counts, CPU, memory, and errors contained within CSG International systems, providing users with insights to troubleshoot production issues and understand system performance.

OpStats additionally has many very specific reports that were often created for an individual product or user. These 10-15 reports, in addition to other reports available in StatHub Portal, were remigrated to StatHubUI in a reusable format to improve usability and modularity within the system. By migrating these visualizations and reports, CSG International aims to enhance functionality in StatHub and deprecate OpStats.

SOUND OF CODE

Sponsor: UNL Computer Science and Engineering

The Sound of Code program is an online JavaScript sonification tool. Essentially, it takes a JavaScript program, parses it, and dynamically plays music corresponding to the execution of the program. The program highlights each line, dynamically showing the execution of the program in real time, as it plays music corresponding to the structure of the code at each line. While sonification can add an interesting new perspective for debugging code, this project is mainly aimed at educating new programmers good coding practices.

To accomplish this, there is a section of the website dedicated to JavaScript resources for beginners and tutorials showing not only how to execute the site, but also detailing how to detect and fix some errors in your program.

Learning to program can be a daunting experience for newcomers. This project seeks to bridge the gap by providing, not only useful JavaScript tutorials, but also a new, fun way to experience your programs. With a suite of example programs users can hear what basic structures sound like and gain an intuition for what common programming practices to use.
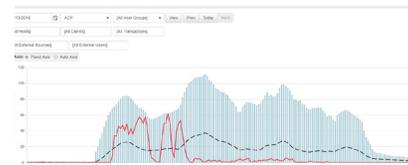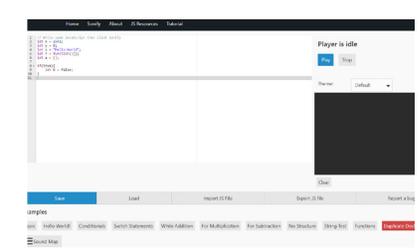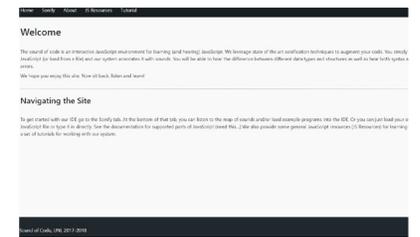
CUBULONIMBUS

Sponsor: UNL Computer Science and Engineering

The aim of this project is to create a test bed for autonomy algorithms for CubeSats. What would be needed is an environment that can allow a physical CubeSat's data to be influenced by the algorithm. Currently, Cosmos would be the tool of choice to view and control the physical Cubesat due to the interface it provides and the tools in place for sending commands. However, as of right now, Cosmos can only handle one Sat at that same time and does not provide a means for sending algorithm command and data to the sat.

The response to this is Cubulo NIMBUS, which aims to provide the handling and control for the autonomy algorithm. This project enables the user to create as virtual CubeSats which can be manipulated similarly to the physical CubeSat. Under this, the autonomy algorithm(s) take in data from both CubeSats, process, and generate responses for each system, tending the system towards an objective. This all enables the user to create a situation that the physical sat to be in along with virtual sats and observe how the algorithm affects the system. Lastly, the data from the system after being generated is stored within log files for further analysis.
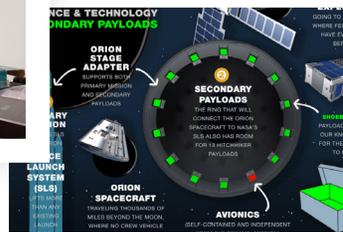
EXPLORING VIRTUAL REALITY

Sponsor: UNL Computer Science and Engineering

This Design Studio team was given the goal of creating a complete virtual reality (VR) experience. With such an open ended project description the team decided to create an entertaining VR experience called Arachnid Person. The hallmark and inspiration behind Arachnid Person is the ability to climb walls. Due to how tightly coupled physical and visual context cues are with respect to movement, motion in VR can be nauseating if there are no physical cues to match the visual ones displayed in the headset. The team's solution was to climb, and through a wide range of user testing, it has proven to be effective.

In Arachnid Person the user can do much more than simply climb though. There are multiple levels, each building in difficulty and skills required. Arachnid Person [the user] has access to four special abilities allowing them to navigate through puzzles and create webs along the way. Finally enemies are featured and can both move and target the user, creating an interactive and challenging environment.
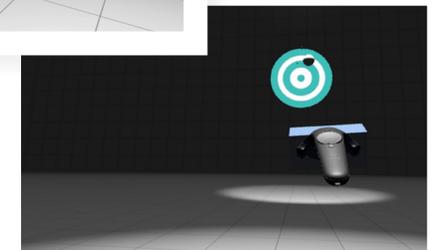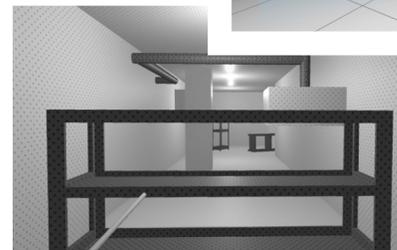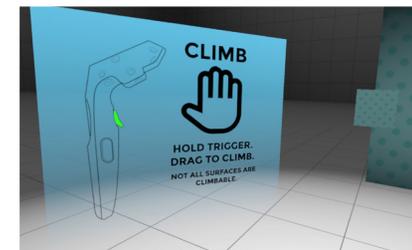
DESIGN STUDIO STATISITCS

TECHNOLOGIES USED

Microsoft .NET **13**

unity **5**

Apple **4**

C# **2**

JS **4**

python **1**

Android **4**

Microsoft SQL Server **1**

Java **2**

Ruby **1**

(globe) **1**

PROJECT DOMAINS

- GEOGRAPHIC INFORMATION SYSTEMS
- RESEARCH AND DEVELOPMENT
- BUSINESS DEVELOPMENT
- MACHING LEARNING
- GAMING
- PRODUCT DEVELOPMENT
- DATA ANALYTICS
- MOBILE
- VIRTUAL REALITY

PROJECT STATS

TOTAL PROJECTS
SINCE 2001 **223** 🚀

Year	Projects
2001	6
2002	7
2003	8
2004	8
2005	8
2006	10
2007	11
2008	10
2009	10
2010	11
2011	11
2012	12
2013	13
2014	18
2015	24
2016	27
2017	29

SLACK STATS

305 MEMBERS

#OVER **50** CHANNELS

15,383 MESSAGES *in the last 30 days

1,327 CUSTOM EMOJIS

DEMOGRAPHIC STATS

(person icon) = 20

TOTAL STUDENTS	168
TOTAL FIRST YEAR STUDENTS	136
TOTAL SENIOR DESIGN STUDENTS	84
TOTAL RAIKES STUDENTS	66
TOTAL CS SENIOR DESIGN STUDENTS	64
TOTAL SECOND YEAR STUDENTS	21

(person icon) = 2

TOTAL ASSOCIATES	18
TOTAL FIRST YEAR ASSOCIATES	17
TOTAL CE SENIOR DESIGN STUDENTS	15
TOTAL FRESHMEN INTERNS	11
TOTAL SOFTWARE DEVELOPMENT MINORS	5
TOTAL SECOND YEAR ASSOCIATES	1

DESIGN STUDIO STAFF & STUDENTS

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Kylie Penner
Events and Projects Coordinator

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Joel Brehm	Bolero Information Systems	Water for Food
Todd Bryant	Nelnet	Spreetail
Paul Cooper	NRC Health	UNL Animal Science
Tom Deter	Assurity	NRC Health
Frank Dolezal	UN Central Administration	CSE Bourke
Nick Ebert	Spreetail	HATCX
Ryan Ebke	Spreetail	CSE Bradley
Brady Garvin	UNL Computer Science & Engineering	NDOT The Cube
Jeff Hale	Agilx	LPS
Jake Heidelk	Spreetail	Realm Five
Nick Hershberger	Fiserv	NET
Michael Hollman	Hudl	Mutual of Omaha
Eric Hunzeker	Pen-Link	Hudl
Shane Kimbrough	UNL Research Finance and Information Systems	NU Sensi-Plate
Rees Kintworth	Hudl	Microsoft Dynamics
Jim Kudirka	Premier Software Systems	TeamMates
Ashlyn Lee	Hudl	TD Ameritrade
Rob Nickolaus	Arbor Day Foundation	Wex Health
JR Noble	UNL - ITS	CSG International
Derek Nordgren	Hudl	NDOT The Portal
Aaron Remaklus	Speedway Motors	CSE Duncan
Everett Rhodes	Don't Panic Labs	Erudite
Carl Steffen	Stone Fin	INFEWS Game
Leon Stewart	Fiserv	Buckle
Bill Udell	Don't Panic Labs	Fiserv
Matt Will	Don't Panic Labs	Westside
Brian Zimmer	Don't Panic Labs	Nelnet

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Zecheng Li
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Ben Melcher
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Dat X. Nguyen
Thien Nguyen
Hoa Nguyen
Nick Nguyen
Hakim Nor Alahyadi
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Blake O'Connell
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Wyatt Osborn
Yongcong Ostby
Andrew Petrzilka
Sean Plowman
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Colin Preister
Michael Purcell
William Quade
Lara Quiring
Muhammad Raimi
Allie Rauner
Henry Recker
Jacob Rehwoldt
Bonnie Ricketts
Caleb Ricketts
Mustafa Ridha

Kyler Robertson
Mary Clare Rogers
Jake Rosebaugh
Elliot Sandfort
Andrew Schmidt
Michael Shanahan
Jacob Shiohira
Artem Shukaev
Brian Simonsen
Justin Sleep
Caston Stack
Emma Stapp
Jack Stobbe
Katy Stuckey
Abhee Subramani
Vignesh Sundramurthi
Daric Teske
Eric Tran
Phuc Trinh
Max van Klinken
Collin Victor
Joel Wach
Emily Wagner
Zach Warneke
Jacob Warner
Derek Waskel
Kenny Waskel
Ethan Weber
Randy Widener
Nick Wieskamp
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