DESIGN STUDIO

JEFFREY S. RAIKES SCHOOL OF COMPUTER SCIENCE AND MANAGEMENT

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REALIGNING PRIORITIES

CHANGE IS THE ONLY CONSTANT IN LIFE AND DESIGN STUDIO.

Design Studio continues to evolve and change, and that is no truer this year than any other year. Certainly one of the most noticeable changes this year has been our split from Computer Science & Engineering's (CSE) capstone program, Senior Design. Starting in 2014/15, Design Studio partnered with CSE to administer Senior Design as part of the Design Studio. This was a significant elevation of the Senior Design program at the time, and brought a larger industry-based capstone to those students. Fast forward to 2017/18 and the explosive enrollment in CSE programs, Senior Design teams and students outnumbered Design Studio. Starting in 2018/19, CSE has now taken the Senior Design program back into their own department, with the knowledge gained of four years of partnership with the Raikes School Design Studio. We wish them the best as their program continues to see a wave of rising enrollment.

Before taking on the Senior Design program, Design Studio since 2004/05 had been recruiting the top students in CSE to join Design Studio teams as full members, referred to as Associates. In fact, the pilot Design Studio Associate was a member of my senior year project with the State of Nebraska Department of Administrative Services – Bryce was a key contributor to that project, and has continued to excel since his time in Design Studio. This year we have 29 Associates, all contributing as equals to their Raikes School peers on teams. The Associates program is a win all around – for more CSE students experiencing Design Studio, for the Raikes School students exposed to more talented people, and for our community extending the impact Design Studio can have. We are excited that we can continue this partnership with CSE, and are piloting expanding this experience to other programs of study such as the College of Business and College of Engineering.

Another change we've seen is the demand to not only be interdisciplinary between management and software engineering, but to also include the more traditional "hard" engineering disciplines (electrical, mechanical, civil, etc.) While Design Studio has had projects here and there that involved these aspects (Stanley in 2004/05, Cerner from 2009-11, HDR from 2013-2015) we are seeing a consistent demand for these types of truly integrated projects – see our Water for Food project on page 10. While we will never move out of the pure software engineering projects, being able to use the additional engineering skills our students possess is very attractive. If you or your organization is interested in sponsoring a project like this, please reach out to us.

We teach our students that Agile principles are all about expecting and adjusting to constant change – after all, it's only fair we have the same expectations of ourselves.

MARK ANTONSON
Director of Design Studio

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. Management principles such as interaction with C-suite executives, team development, leadership, and sponsor and risk management are learned hands-on. Students leave Design Studio having gained experience that places them two to three years ahead of peers graduating from college.
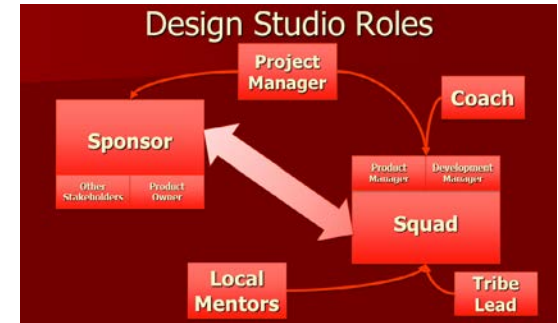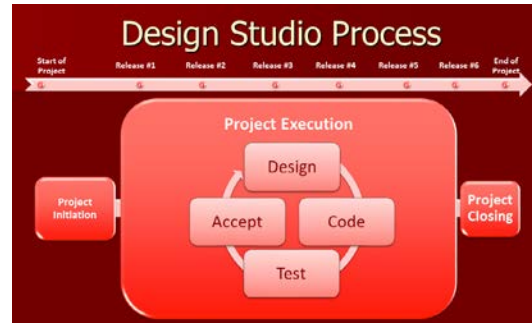
Since its beginning in 2001, Design Studio teams have completed well over 200 projects for more than 80 distinct partner organizations including Microsoft, Hudl, Mutual of Omaha, IBM, PayPal, and Fiserv. Some successful projects include video analysis tools for student and professional athletes, way finding solutions in hospitals, new approaches to state food assistance programs, predictive data

tools for health care, and mobile technologies supporting e-commerce companies. Whether it is an open-ended problem needing multiple creative solutions, or a well 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 initiation. After the sponsor orientation in mid-August, projects are rolled out to students and teams formed at the beginning of the school semester. Student teams are comprised of around 5 high-achieving college juniors and seniors working 12-15 hours per week during the 29-week academic year, 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.

OVERVIE

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. Leverage design thinking to determine process for execution of project.

PROJECT EXECUTION

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

CHECKPOINTS/RELEASES

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

PROJECT CLOSING

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

SQUADS

Students self-organize into teams, referred to as squads. Squads have two specific roles, the Development Manager and Product Manager, who together serve as a leadership team for the squad.

PRODUCT OWNER

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

PROJECT MANAGER

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

TRIBE LEAD

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

COACH

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

MARK ANTONSON

Director of Design Studio

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

BHUVANA GOPAL

Assistant Director of Design Studio

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

CHERYL NELSON

Design Studio Project Manager

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

JEREMY SUING

Design Studio Project Manager

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

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 24 years of Design Studio experience
– keep reading to meet our core staff. Of course four
people can't possibly support 101 students in a program
like Design Studio – it takes a village of other faculty,
staff, and volunteers, so flip to page 22 to see credit where
credit is due.

STAFF

PROJECTS

fiserv.

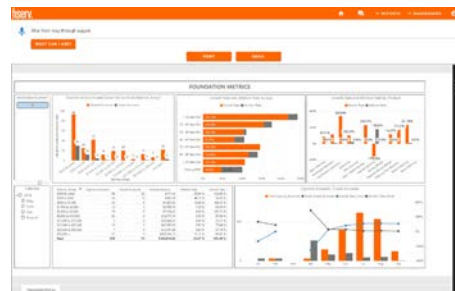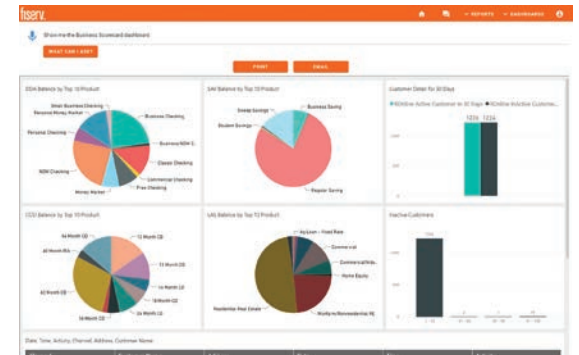# CONVERSATIONAL INTERFACE FOR INTERACTING WITH INFORMATION

SPONSOR: FISERV

Fiserv, Inc. is a global leader in financial services technology solutions. We're helping more than 12,000 clients worldwide create and deliver experiences for a digital world that's always on. Solutions that enable today's consumer to move and manage money with ease, speed and convenience. At the point of thought.

The Fiserv team is pushing into a new frontier of digital interaction in the banking industry: voice navigation.

A financial institution's executive team is constantly seeking information about the financial health of their institution and their customer base. Today, much of this information is delivered via pre-defined reports and dashboards. Changes to this data requires additional IT experience with SQL and or business intelligence tools. The team was tasked with creating a voice assistant which interacts with PowerBI reports and dashboards using natural language commands. Aimed at removing the technical knowledge needed to interact with reporting software, the team developed an application which connects employees to their company's PowerBI workspace and gives access to over a dozen different commands to manipulate reports. The Voice User Interface (VUI) developed by the team removes much of the technological barrier when interacting with PowerBI and increases productivity for banks across the nation.
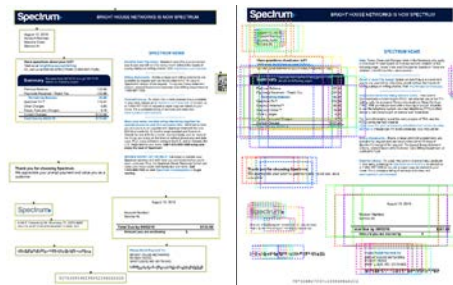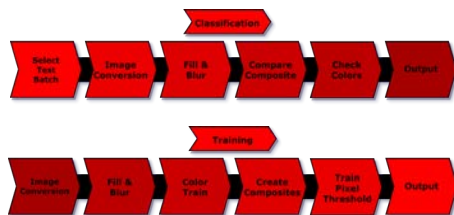
PDFsense

SPONSOR: CSG INTERNATIONAL

CSG International output solutions composes hundreds of millions of billing statements a year, in print and digital form for clients around the globe. These statements need to be prepared and delivered quickly and mistake free. A mistake in document preparation can mean that tens of thousands of documents need to be re-composed and reprinted, costing CSG time and money, and holding up other orders. While these mistakes do not happen often, there is value in catching and fixing them before they reach their final destination.

To achieve this, the design studio team created PDFsense, a python system that can learn statement formats, and then classify whether a new batch of documents conform to the statement type. PDFsense works by comparing thousands of documents of the same format to create composites that then can be compared to documents that need to be classified. The system then gives visual output for where the mistake has occurred on documents to let developers know what type of mistake has occurred so it can be fixed, and the printing process can continue. The system can be trained on any number of statement types, and gives results quickly as to not hold up the printing process. PDFsense allows CSG to automatically train and test each batch of statements sent to the printing facility quickly and prevent printing of incorrectly formatted documents.
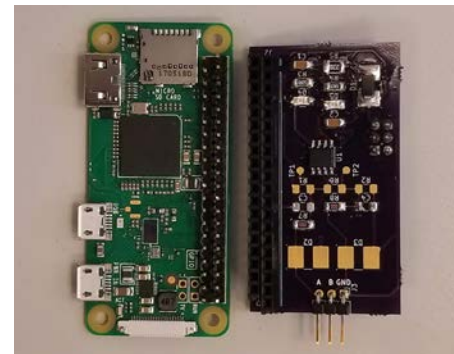

ENERGY AND WATER DATA STREAMER

SPONSOR: DAUGHERTY WATER FOR FOOD GLOBAL INSTITUTE

The Daugherty Water for Food Global Institute (DWFI) currently owns many water energy meters that monitor electric irrigation pump energy usage. These meters were originally designed to collect and transmit data via a cellular modem component of the meter. However, cellular connectivity is often poor in rural areas, and some meters are unable to establish the connection needed to transmit the data. Furthermore, the meters currently have no storage functionality, so any data that fails to send due to poor cellular connectivity is lost. To address this problem, the goal of the Energy and Water Data Streamer project is to develop an easily reproducible hardware-software data pipeline that enables farmers to retrieve, store, and visualize water pump energy measurements without relying on cellular connections.

The solution is a three-part data pipeline that transfers data from the meters to the cloud. The first component is an embedded hardware-software system that uses a custom hardware adapter board and a Raspberry Pi to extract, locally store, and expose meter measurements. A mobile app allows farmers to connect to the wifi network produced by the Raspberry Pi and sync their phone with the meter, collecting recent measurements and passing them onto the cloud once a cellular connection is established. A web application receives the data from the mobile app, storing it in the cloud and providing an API that allows external services to access the energy data. In addition to the data pipeline, the web application also provides DWFI functionality to administer over the entire pipeline, including managing all users, meters, and data.

PAYMENTSPRING

SPONSOR: NELNET

PaymentSpring Gateway is a payment processing platform subsidiary of Nelnet, Inc. It processes online and in-person payments for stores, nonprofits, and e-commerce companies. The Gateway has a dashboard where users can see information about their transactions over the past thirty days. However, the PaymentSpring platform has access to much more data which, prior to this project, was untapped for customer use. The goal of this project was to research, design, and develop an updated dashboard that allows users to view more information about their payments, understand their financial data, and make better business decisions.

The PaymentSpring Gateway project team developed a set of five analytics which are displayed on the Dashboard. The analytics (Monthly Recurring Revenue, Customer Lifetime Value, Transaction Method Breakdown, Geographic Transaction Data, and Historical Transaction Data) are displayed dynamically, meaning the charts can be filtered by different dates and data types (which vary depending on the analytic). Each chart is interactive and responds instantly to the user's filter choices and unique data structure.

The PaymentSpring project also developed an analytics API to support the development of more dashboard metrics, and eventually allow user-created graphs to be created. The microservice API uses a memoized database of all transactions that supports a wide variety of data visualization possibilities. The robust backend of the metrics developed by the Design Studio team will allow PaymentSpring to create new metrics based on specific user business cases, and eventually allow users to design their own custom graphs.

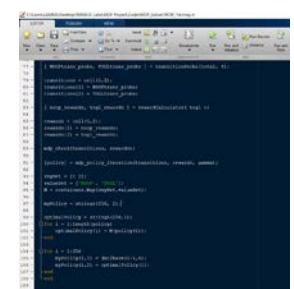# ON-THE-FLY MDP UPDATING

SPONSOR: NIMBUS LAB

The UNL NIMBUS Lab is researching the complex, interdisciplinary problem of on-the-fly mission plan updating. The lab is developing lightweight, updatable On-the-Fly Markov decision processes (MDPs) to allow cyber-physical systems to make near-optimal decisions online. Current state-of-the-art MDPs are generally solved offline and do not adjust to changes in the mission model. Our novel, updatable MDP formulation can accurately model the stochastic evolution of a physical system while simultaneously preventing the state-explosion problem encountered when modeling complex systems.

To demonstrate the predictive capabilities of our MDP formulation, we designed a control authority switching system to assess the potential for pilot loss of control and make a decision about whether to hand control to a provably safe computer control system to avoid a crash. The switching algorithm models the pilot-UAS interaction as a MDP, accounting for the stochastic nature of the user's control inputs and vehicle state. To train the MDP we utilized 13 drone pilots ranging in skill level and conducted 103 flights of varying difficulty, collecting all position and orientation data alongside user skill level. Finally, we evaluated the effectiveness of our MDP policy on the non-training flight data, demonstrating a 75% success rate in predicting the outcome of the flight.

Flight	Time Before LOC (s)
1	11.2050
2	16.6200
3	3.8050
4	17.2500
5	9.5550
6	9.2950
7	23.5450
8	7.2900
9	12.3150
10	5.4100
11	14.1300
12	8.1550
13	13.1400
Average Predictive Horizon:	12.55 s

DIGITIZATION OF THE COACHING EXPERIENCE

SPONSOR: GALLUP

The Gallup CliftonStrengths are 34 characteristics that describe the way a person thinks and operates. But in order for someone to fully reap the benefits of knowing their strengths, they need to fully understand them and apply them to their everyday life. The Gallup Strengths Coaching program aims at training coaches to uncover how in individuals' strengths impact their everyday lives and how they can leverage those strengths to be the most successful they can be. Unfortunately, this experience is expensive and limited to those who are able to hire a strengths coaches. The Digitalization of the Coaching Experience project aims at creating a virtual coaching experience that provides the same utility as an in person coaching experiences, but with a much lower barrier-of-entry.

For the 2018-2019 year, the goal of the project was to create a data-driven algorithm that will result in a chat-bot that can ask insightful questions and carry a conversation catered towards a user's Gallup Strengths. The first phase of the project was to collect data for the algorithm. To accomplish this, the team created a WebApp that is a mock chatbot that the users interact with and thumbs-up or thumbs down questions. Using the collected metrics, three models were trained that predict the best next question to ask the user. Asking insightful questions is the first step towards creating a virtual coach.

Feedback Over the Past Week

INVENTORY REDISTRIBUTION OPTIMIZATION

SPONSOR: 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 450 retail stores in 42 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 optimizes its inventory company wide to ensure that the product is in the location with most likelihood to sell. 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. Until now,

the metrics used by the analysts to conduct inventory redistributions have been based solely on past and current inventory for a small time-frame.

Buckle's objective for this year was two-fold: it wanted a way to optimize the redistribution algorithm generated last year by using demand forecasting and improvements on the redistribution process to minimize movements. As a solution, our team prototyped an algorithm using linear programming and forecasting sales to reduce errors present in the old solution. We also built upon last year's project to display forecasted sales for the following six weeks and an optimality metric onto the application. With these, analysts can see how close they are getting to the optimal redistribution while working on the redistribution. We also created a new page on the current application that displays a ranked list of products based on various calculations. Now, analysts can see which products would be the most optimal to redistribute at that specific point in time and is closer to its goal of moving product in a way that maximizes profits.
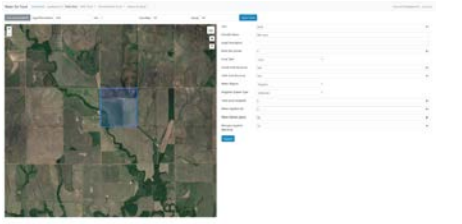
ONLINE AGRICULTURAL DATA MANAGEMENT SYSTEM

SPONSOR: DAUGHERTY WATER FOR FOOD GLOBAL INSTITUTE

Inheriting last year's Platinum Project, the Water for Food A team had a great foundation to build on. Last year's project focused on visualizing confidential data from agricultural producers' mandatory reports to Natural Resources Districts (NRDs). Their project allowed agricultural producers to see how data about their individual fields compared, anonymously, to fields with similar soil and climate and allowed NRD Managers to see geospatial data about agricultural producers in their district to target outreach and track impact of policy. This year's team added trends to visualize changes in data over time; rather than just in a single year. Further, this year's project added more metrics to better contextualize data such as Nitrogen-Balance and Total Water Usage.

Further, the team this year added the ability for agricultural producers to upload their data.

This electronic collection makes reporting easier, more consistent, and less labor intensive. Agricultural producers will have the option to upload their data through a mobile application, or on the web page.

Perhaps most importantly, this team has taken the software from a demo state to a production state. Code coverage has increased from 35% to 80%. The sponsor has had consistent access to the deployed version of the site, and has given feedback from actually using the software with end users. The transition has focused on providing the sponsor with a software product ready for real use and further development outside of Design Studio. The tool will be used by NRDs to prioritize education and policy programs in their district and will enable producers to see how they're doing in terms of managing their farm inputs and yield.

CREATING SUPERIOR CLIENT EXPERIENCE

SPONSOR: TD AMERITRADE

The goal of this project is to help TD Ameritrade, specifically Brokerage Operations, utilize text-based client survey responses to identify ways to better TD Ameritrade's client experience, increasing client satisfaction and retention.

TD Ameritrade conducts satisfaction surveys every month, and it's very important to TD Ameritrade to understand clients and help them invest for the better. Surveys are currently analyzed by hand to strive for operational excellence and create the best possible experience for clients. However, analyzing the surveys consumes a lot of time and manual work.

To streamline this process, the team was asked to build an application to perform sentiment analysis to analyze these large quantities of text-based survey responses, and identify opportunities to improve operational effectiveness.

The solution automatically performs sentiment analysis on incoming survey results to classify text responses as positive, negative, or neutral. The visualization tools give insight into what's happening in the surveys for internal processes and what the text sentiment-based net advocacy score for Brokerage Operations is in the last 30 days. The visualization tools allow analysts to dive deeper into survey data by searching through surveys by date, internal process, keywords used, and more. The tool also allows analysts to track text-based net advocacy scores over time to understand how changes made to internal processes have affected their client experience.

These tools combined will allow TD Ameritrade management to more efficiently diagnose problems and enhance client experience.

NOT DOZER

SPONSOR: PROXIBID

Project "Not Dozer" brings image recognition and machine learning to Proxibid's item inventory management tools. Proxibid, the leading online Marketplace for highly valued items offers over 100,000 items weekly for over 4,000 auctioneers. Each item is manually classified into one of their 2,200 categories by a Proxibid Data Specialist using the titles, descriptions and images provided by the sellers. As Proxibid grows, so does their need for additional automation of this process.

The Design Studio Team created and then integrated the architecture of Hierarchical Deep Convolutional Neural Network (HD-CNN) and a predictive training model into the Proxibid's categorization tool. Using over a million previously categorized items, the team created their first trained model that became the foundation of a product that now identifies, predicts, presents, and then learns. This product will reduce the Data Specialist's need for manual classification and allow them to work on other, monetizable item development features. As well, the buyers can now search and find an auto-classified item almost immediately upon the seller uploading a catalog, bringing in more views, bids and online purchases.
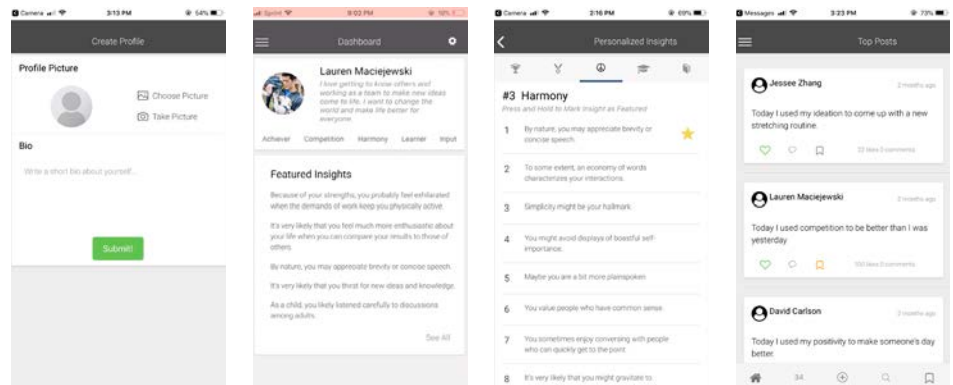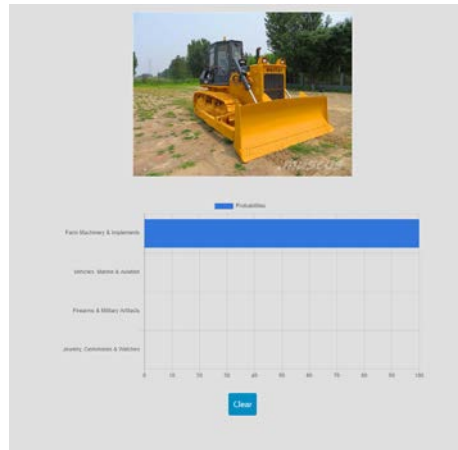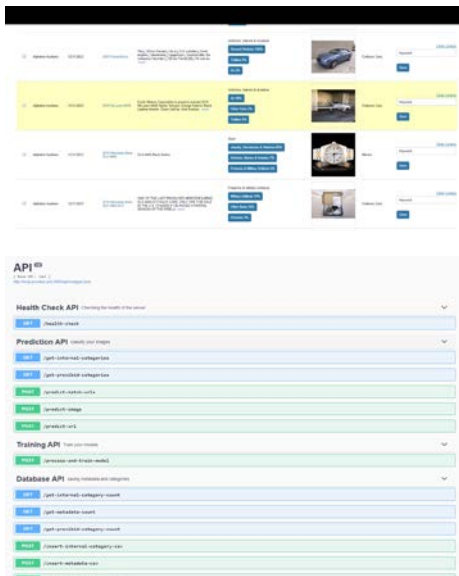
CLIFTONSTRENGTHS HIGHER ED TRANSFORMATION

SPONSOR: GALLUP

Gallup aims to engage college students with their CliftonStrengths to foster personal growth and enhance their college experience. The solution will drive user engagement with CliftonStrengths long after they have taken the initial assessment. The application aims to inform students about their talents, motivate them to use their strengths, and connect them with other college students exploring CliftonStrengths. By better understanding their themes, college students learn more about themselves leading to a more fulfilling college experience.

The solution is an Android and iOS application that allows users to fully experience CliftonStrengths. The application provides resources surrounding all of the themes and connects college students with content from Gallup. Users are able to see their personal insights and choose what insights they want to share with their friends. Outside of the profile, users can add friends allowing them to view others' strengths and insights. Students can view and create teams with other students allowing them to learn more about their team's strengths and domain distribution. The final major feature of the application is the communities section. In this section, users can share content, comment, like, and save posts as well as follow certain hash tags. The goal is to create a central location for conversations surrounding CliftonStrengths.
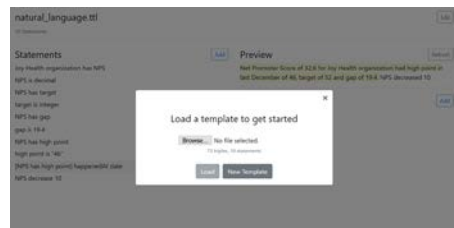
NATURAL LANGUAGE GENERATION

SPONSOR: NRC HEALTH

In a recent survey, NRC Health found that 80% of their users struggled to interpret the various charts and data supplied by their systems. Natural Language generation solves this problem by creating straightforward sentences that highlight the most important trends. It's fully customizable to individual customers and can write natural-sounding descriptions of everything from a number crossing a threshold to complex interplays between trend lines, time periods, and relative importance. All of this is controlled by a modern web interface, which can be used by technical and non-technical users alike.

NRC considered existing commercial solutions to their problem, but those products could only handle substituting a few predetermined words or numbers into whole phrases that had to be written ahead of time. This project's natural language engine uses an advanced five-layer system based on the latest computer language processing research to translate numbers into plain English, giving it a flexibility existing solutions are unable to match. Because of its dynamic approach, sentences reform, combine, and rearrange fluidly based on shifts in input data and the needs of the user. Instead of requiring entire prewritten paragraphs, the project's interface features a live preview, which displays the wholly machine-generated text and allows users to make any final customizations. The engine is fully decoupled from the web interface, so it can switch from generating preview paragraphs to operating in a production environment with minimal adaptation. This allows it to be integrated across any of NRC's many data-driven products, summarizing the most important data across their portfolio.

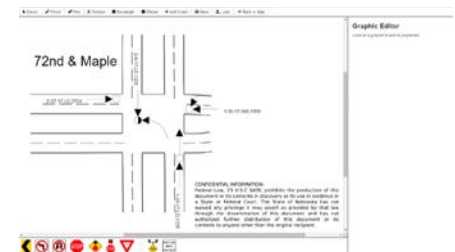# VEHICLE CRASH INFORMATION PORTAL - CRASH DIAGRAM

SPONSOR: NEBRASKA DEPARTMENT OF TRANSPORTATION

Citizens of Nebraska expect the state government to keep their roadways safe. The Nebraska Department of Transportation (NDOT) studies trends related to car crashes across Nebraska to design safer roadways and make decisions that will save lives. To identify these trends, an analysis of an intersection is done by creating a crash diagram – a visual rendering of the query specific crashes associated with that intersection.

These diagrams, in the present day workflow, are drawn manually using a CAD program and take anywhere from 4 to 16 hours to complete. What is worse is that these diagrams are not redundant – meaning that drawing two diagrams for the same intersection under two different queries requires creating a new diagram. This process is inefficient and it distracts from the primary goal: identifying roadway safety improvement opportunities.

This project cuts right through the problems of hand-drawn crash diagramming by streamlining the process to get quick, query generable diagrams that enable analysts to focus on the decision to act. The Design Studio team created a full canvasing suite that enables analysts to interact with crash data without being slowed down by meticulous, manual work. With this application, the analysts gain the ability to create a crash diagram faster, easier, and with less training than ever before – bringing new efficiency and value to Nebraska tax dollars.
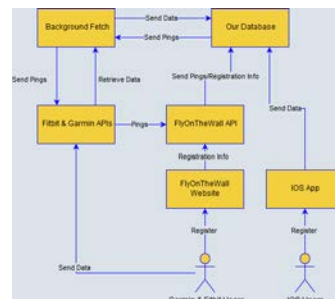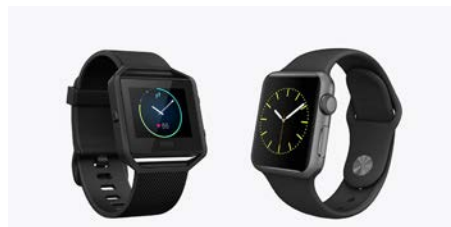
INTERNET OF THINGS 2.0

SPONSOR: MUTUAL OF OMAHA

The Internet of Things 2.0 project supports the life insurance underwriting process by giving insight into a wearable user's health. It creates a machine learning model using data gathered from wearable devices such as Fitbits, Garmin watches, and Apple watches to classify individuals in risk classes according to their health. Users are able to register their devices through a web application created by last year's Design Studio team, and their data is automatically fetched periodically through a background process.

Python code was used to securely extract data from Mutual of Omaha's database and to develop several types of machine learning models including decision trees, random forests, and clustering models. These models used measurements such as steps, calories, and distance to explore ways to classify individuals into risk classes that correlate directly to Mutual of Omaha's insurance products. These were then entered in a model tournament to compare the performance of each model. The models, combined with extensive research, provide new insight for underwriting and opens the door for a customer wearable program to be launched in the future.

USING MACHINE LEARNING TO SCREEN IN TALENT

SPONSOR: MICROSOFT

A large company like Microsoft may receive thousands of resumes for job openings each month, making it extremely difficult or even impossible to review every resume. Additionally, many applicants may apply for one position when they are better qualified for another. Microsoft would like to explore ways to choose the best candidates from the ones available, while also recommending jobs that are a good fit to applicants.

The Design Studio team worked to create a resume scoring algorithm that would be able to evaluate an applicant across all available listed jobs. Through the use of machine learning technique such as NER Tagging and Word2Vec, the team was able to create an algorithm that will score applicants based on technical skills, relevant work history, and the quality of their education. An application's resume is scored across all jobs and will be recommended for the job that best fits their skills. The application allows Microsoft to quickly sort through all of the resumes they receive and get a preliminary evaluation of an applicant's quality. The work of the Design Studio team will be used and expanded upon by Microsoft following project completion.
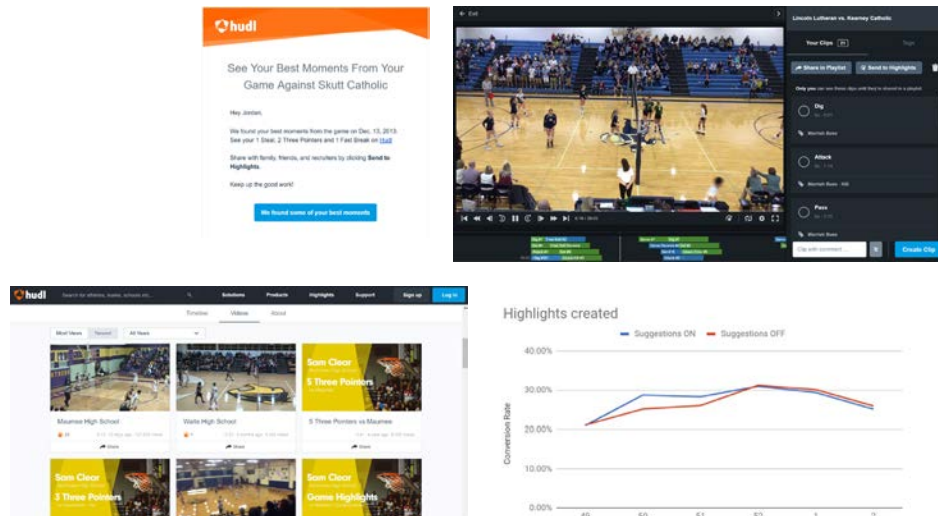
HIGHLIGHTS ARE EASY

SPONSOR: HUDL

Design Studio was tasked with finding a solution to a long-standing issue at Hudl: increasing highlight engagement with V3 (basketball, soccer, volleyball, lacrosse, and hockey) athletes. Currently, the highlight creation process is lengthy and involves lots of steps. Highlights are a key element of Hudl and their community, so they want highlight creation to be simple and fast.

To go about solving this problem, Design Studio started by interviewing stakeholders and users, exploring the product, and brainstorming possible solutions. Once this phase was complete, medium-fidelity mockups were made and then user tested. Based on the results of these AB and user tests, solutions were altered or scrapped altogether.

Eventually, the students landed on the Notify and Filter solution. Whenever a coach or Hudl Analyst finishes tagging a video, users are sent an email. The email states that the user's best moments are now available to view on Hudl. Once the user clicks that link, they are sent to a screen with the user's best moments from their recent game. This removes the portion of highlighting where users have to comb through game video to identify their best moments, the most arduous portion of the process. Based on user and AB testing results, this solution will be available to basketball users by next season.
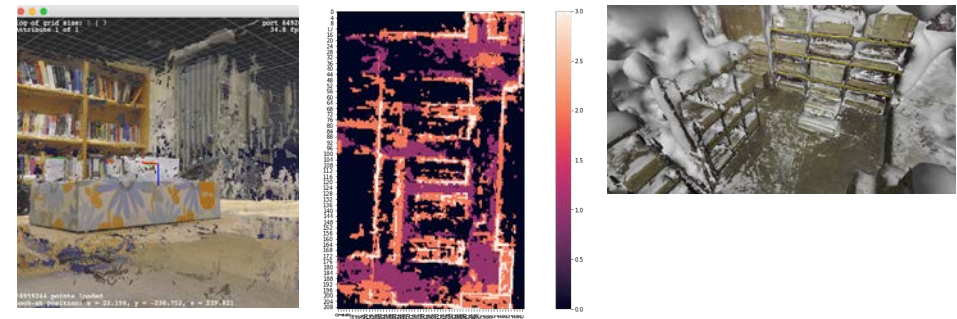

INTERACTIVE WAREHOUSE MAPS GENERATED FROM 3D MODELING SOFTWARE

SPONSOR: DMSi

When speaking to warehouse workers in the Lincoln and Omaha areas, the DMSi DS team noticed a common thread: the problem of disorganization. Few warehouses keep detailed layouts of their facilities on-hand, relying solely on the memories of their workers to locate specific items. This makes it especially difficult to train new employees in the warehouse organization.

The team decided to tackle this problem by generating 2D maps of warehouses using 3D modeling software, creating a product designed to be intuitive enough to be operated by warehouse workers with little software experience. It starts by taking a video of a warehouse - for testing, we captured footage at Central Lumber of Lincoln using a flying camera drone. This video is then used to create a 3D point cloud of the warehouse, which in turn is transformed into a top-down 2D heatmap that recognizes shelves, walls, and products. This map is displayed in a web application that can be made available to everyone who works in the warehouse, complete with pictures of the products at any given set of coordinates.

Spreetail

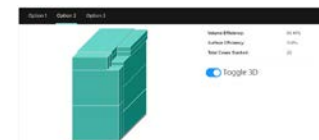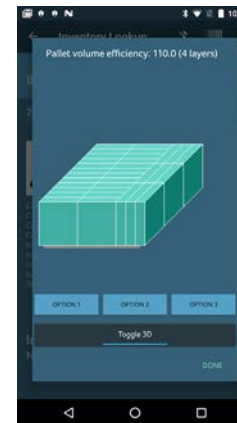# PALLETIZER/WAREHOUSE OPTIMIZATION

SPONSOR: SPREETAIL

Spreetail is an e-commerce company that is currently operating with eight fulfillment centers. Each location is responsible for storing, packing and shipping products to customers. Spreetail has over 15,000 unique items ranging from pools to kitchen appliances and nearly everything in between. With this wide range of products, the placement and management of items is a key component. Within the warehouse, Spreetail uses pallets, or wooden platforms, to organize incoming product shipments. These pallets must be thoughtfully stacked to reduce safety concerns and maximize productivity and space efficiency.

To address this growing concern for incoming shipments, the Spreetail Design Studio Team has developed the Palletizer. The Palletizer is a tool that generates pallet placement patterns to help fulfillment center (FC) employees stack boxes safely and efficiently on pallets. In the warehouse, FC employees can scan a barcode or search for an item to generate three palletization pattern options, which differ in box orientation. From there, they choose the best option based on the integrity of the cardboard box. In our web application, employees are asked to enter a unique item identifier or item dimensions through a web portal. Then, we create pallet placement patterns based on the dimensions requested. The web application also displays

statistics such as volume efficiency, surface efficiency, number of layers and cases per layer. Employees are also able to manipulate certain constraints such as maximum weight or maximum height of the pallet. To further assist employees with labor and time forecasting, we also created a reporting tool. This tool allows employees to enter a list of item identifiers and creates an excel sheet containing efficiencies and other statistics for each item entered.

Furthermore, our team was able to tackle the problem of outgoing shipments. These shipments contain multiple boxes that can differ in dimensions. The priority in this instance is optimizing the space efficiency which will lead to decreasing shipping costs. Employees can enter a list of item identifiers or item dimensions and receive step-by-step instructions for packing along with an image of the finished product.

Our solution is currently deployed on all Spreetail systems and being used by over 200 FC employees. We are fortunate enough to receive valuable user feedback that has enabled us to continuously improve upon our product. Our product is already saving Spreetail time and space within the warehouse and will decrease the total amount of safety incidents over time.
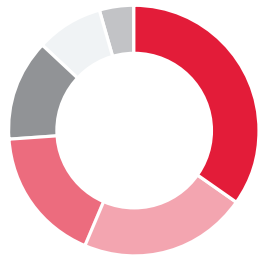
STATISTIC

PROJECT DOMAINS

- ● ANALYTICS
- ● MACHINE LEARNING
- ● NATURAL LANGUAGE
- ● MACHINE VISION
- ● RESEARCH & DEVELOPMENT
- ● EMBEDDED SYSTEMS

PROJECT STATS

TOTAL PROJECTS SINCE 2001 **241**

Year	Value
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	28
2017	29
2018	17

SLACK STATS

173 MEMBERS

119 CUSTOM EMOJIS

OVER **30** CHANNELS

↑ **505** FILES UPLOADED IN THE LAST 30 DAYS

✉ **8,527** MESSAGES IN THE LAST 30 DAYS

DEMOGRAPHIC STATS

TOTAL STUDENTS = **101**

🯅 = 5

SECOND YEAR RAIKES STUDENTS	33
SECOND YEAR ASSOCIATES	1
FIRST YEAR RAIKES STUDENTS	26
FIRST YEAR ASSOCIATES	28
SOPHOMORE INTERNS	5
FRESHMEN INTERNS	8

TOTAL SPONSORS = **15**

🏢 = 2

FIRST TIME SPONSORS	3
NEBRASKA-BASED ORGANIZATIONS	12
LINCOLN PRESENCE ORIGINATIONS	7
OMAHA PRESENCE ORGANIZATIONS	6

DESIGN STUDIO FACULTY & STAFF

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DESIGN STUDIO COACHES

	COMPANY	PROJECT
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Tom Deter	Assurity	NRC Health
Nick Ebert	Spreetail	Water for Food B
Yama Farani	TD Ameritrade	Microsoft
Jeff Hale	Agilx	Mutual of Omaha
Jake Heidelk	Spreetail	CSG International
Nick Hershberger	Fiserv	Proxibid
Michael Hollman	Hudl	Water for Food A
Ashlyn Lee	Hudl	Nelnet
Rob Nickolaus	Arbor Day Foundation	Fiserv
JR Noble	UNL - ITS	Hudl
Derek Nordgren	Hudl	Gallup A (Fall)
Everett Rhodes	Don't Panic Labs	Nebraska Department of Transportation
Chad Scribner	Firespring	Gallup B
Leon Stewart	Fiserv	Buckle
Matt Will	Don't Panic Labs	TD Ameritrade
Brian Zimmer	Don't Panic Labs	Gallup A (Spring)

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Jared Fuelberth	Duc Le	Jack Stobbe
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Henry Harrison	Spencer Nussrallah	Mason Wright
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Allison Inman	Brendan Owens	Jessee Zhang

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