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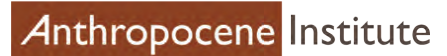
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CSE 498 Collaborative Design

CSE 498, Collaborative Design, provides the educational capstone for all students majoring in computer science. Teams of students build software systems for a variety of clients.

During the capstone experience, students

- design, develop, debug, document, and deliver a comprehensive software system,
- work in a team environment,
- become proficient with software development tools and environments,
- develop written and oral communication skills,
- build and administer computer systems, and
- consider issues of professionalism and ethics.

Our clients are local, regional, and national including Ally Financial, Amazon, Anthropocene Institute, Auto-Owners Insurance, Bosch, Corewell Health, Delta Dental, General Motors, Google, HAP, Henry Ford Innovations, Kohl's, Launch, Magna, McKesson, Meijer, Microsoft, Mozilla, MSU Federal Credit Union, NetJets, Stryker, TechSmith, Union Pacific, United Airlines, Urban Science, UWM, Vectra AI, Volkswagen, Whirlpool, and WK Kellogg Co.

Ally Financial Data Consistency and Reconciliation Tool

Ally Financial is an industry leader in financial services headquartered in Detroit, Michigan. As one of the largest online-only banks, Ally Financial provides their approximately 11 million members with a full suite of banking and financial services powered by ever-advancing modern technology.

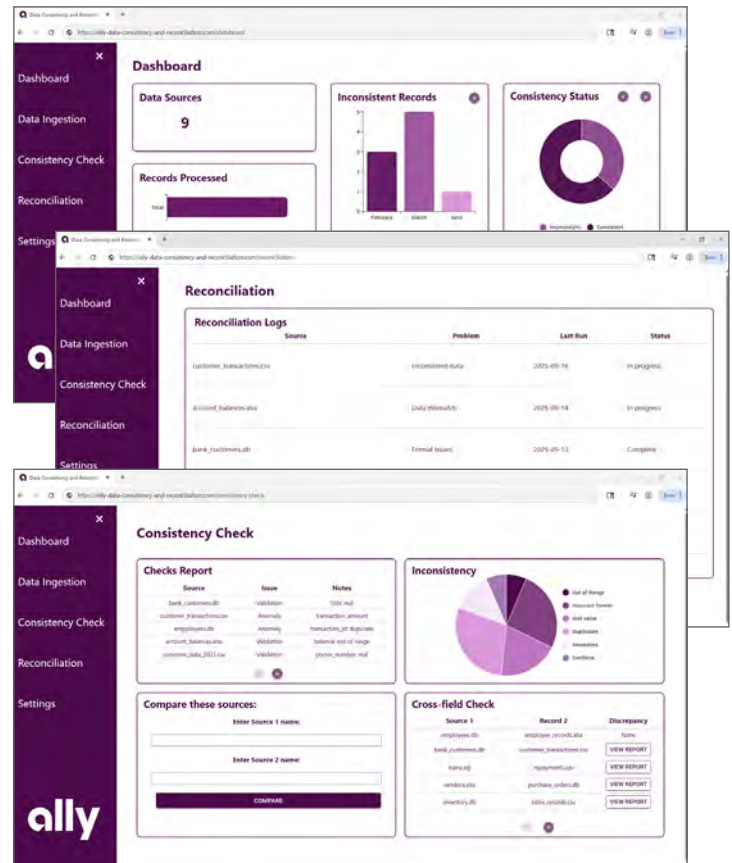
Focusing on the rapid growth in data-driven decision-making, Ally Financial's experts analyze various types of data across multiple sources for critical processes. The analysis process requires effective management of varied and abundant data to ensure consistency and accuracy which is time-consuming and may cause overlooked discrepancies if done manually.

Our Data Consistency and Reconciliation Tool streamlines the process by analyzing and validating multiple data sources. The tool automatically detects anomalies and generates reports highlighting issues.

When using our web-based application, users are first presented with a dashboard showcasing a summarized overview of data sources and consistency checking displayed through various charts and tables. On the data ingestion page, users upload data sources in various formats to be analyzed. The tool applies predefined validation rules for consistency checking, and any mismatches present are analyzed between two different data sources for reconciliation, logging discrepancies to provide an inconsistency history.

Our tool cuts down on the complexity and time cost associated with analyzing and reconciling multiple types of data, giving Ally Financial's experts more time for other endeavors.

The user interface is developed using React. Data is stored and processed in Snowflake, a cloud-based data warehouse platform. Flask, a Python web framework, is used to transfer data between the front end and database.



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Amazon Seller Agent Management Platform

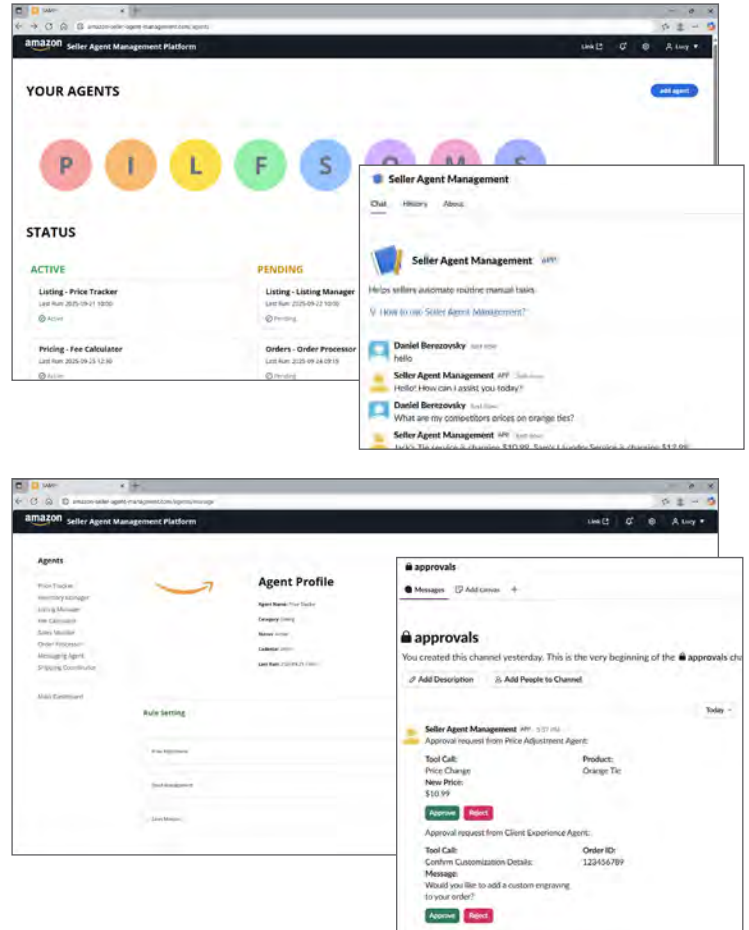
Amazon, headquartered in Seattle, Washington, is a global leader in technology and an e-commerce powerhouse. Originally founded by Jeff Bezos in 1994 as a book marketplace, Amazon has since expanded to be one of the most influential and well-known online selling platforms throughout the global market.

To maximize sales, sellers on Amazon are responsible for performing many tasks. These include responding to customer inquiries, adjusting prices based on competitors, remembering when to stock new inventory, processing returns, and many more. Currently, these tasks are performed manually, requiring sellers to either take time out of their day or hire extra employees to accomplish these tasks.

Our solution, the Seller Agent Management Platform, addresses these challenges by enabling sellers to create customizable agents to automate tasks set by the seller. By offloading tasks, such as price adjustments or inventory stocking, to our advanced AI agents, sellers can save time while maintaining the same quality Amazon buyers have come to expect.

Users create agents through our web application, where they provide the agent with rules and settings on how to operate through our easy-to-use interface. Some of these settings include having the agent react to real-time events, assigning a task by providing a prompt, and specifying which capabilities the agent can or can't have, as well as which actions need human approval before use. Sellers communicate with agents and approve agent actions using Slack, a messaging platform.

Our platform leverages AWS technologies such as Bedrock for LLM inference and Amazon Bedrock AgentCore for running the agents and accessing tools. The web application front end is built with NextJS, while the back end uses FastAPI, Amazon API Gateway, and Amazon Elastic Container Service.



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Anthropocene Institute Modeling Michigan's Energy Future

Founded by Carl Page, The Anthropocene Institute bridges investors, policymakers and institutions with the goal of combating the global climate emergency. The Anthropocene Institute has risen to the forefront of both green technology and education through promoting clean and sustainable energy.

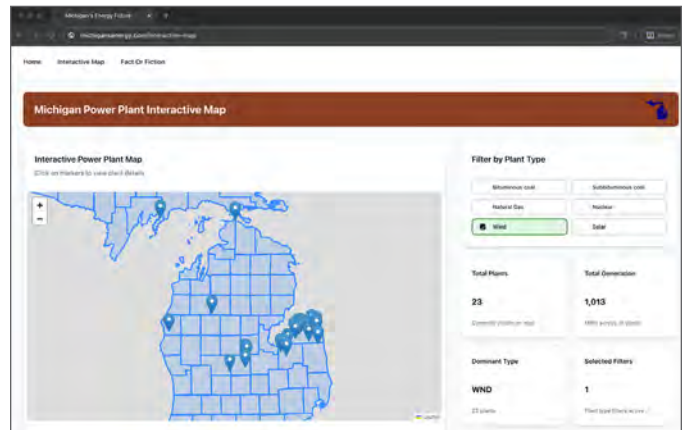
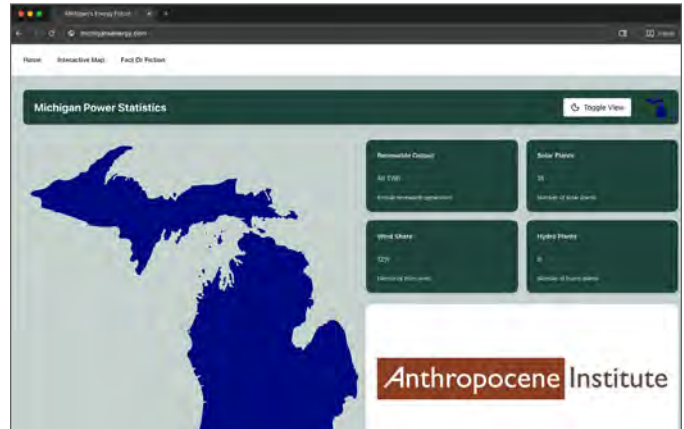
Investment in renewable energy is a crucial first step in reversing the damage done to the environment. However, not all solutions are equal. Nuclear power provides a highly efficient, scalable and reliable way to replace current non-renewable power hegemony. Nuclear power does all this while being incredibly safe, having caused not a single death within the last decade. Despite this, public opinion remains skeptical.

Our Modeling Michigan's Energy Future website contains an interactive map where users view the different power plants within the state of Michigan. Users interact with the plants and change the source of the power they generate before observing the estimated effects of their changes in real time.

The Modeling Michigan's Energy Future website also provides the user with current statistics relating to Michigan's actual electricity usage, generation, and prices. Users view projections of Michigan's power supply and grid pollution where all fossil fuel plants have been transitioned to nuclear plants.

Our website helps spread awareness of nuclear energy through a public-facing, engaging and educational platform. It encourages the public to challenge their preconceived notions regarding wind and solar being safer and more cost-effective. Most importantly, it cements nuclear power as the most feasible clean energy source.

The front end is built using Next.js with React, while the back end utilizes Flask with Python. PostgreSQL provides data storage with pandas handling data processing. Interactive mapping is done through leaflet and charting uses Recharts and Shadcn.



Anthropocene Institute



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Auto-Owners Insurance

AO Quick Capture

Auto-Owners Insurance is a Fortune 500 company that provides automotive, home, life, and commercial insurance to nearly 3 million policyholders in 26 states. Headquartered in Lansing, Michigan, the company is recognized for exceptional financial strength and customer service.

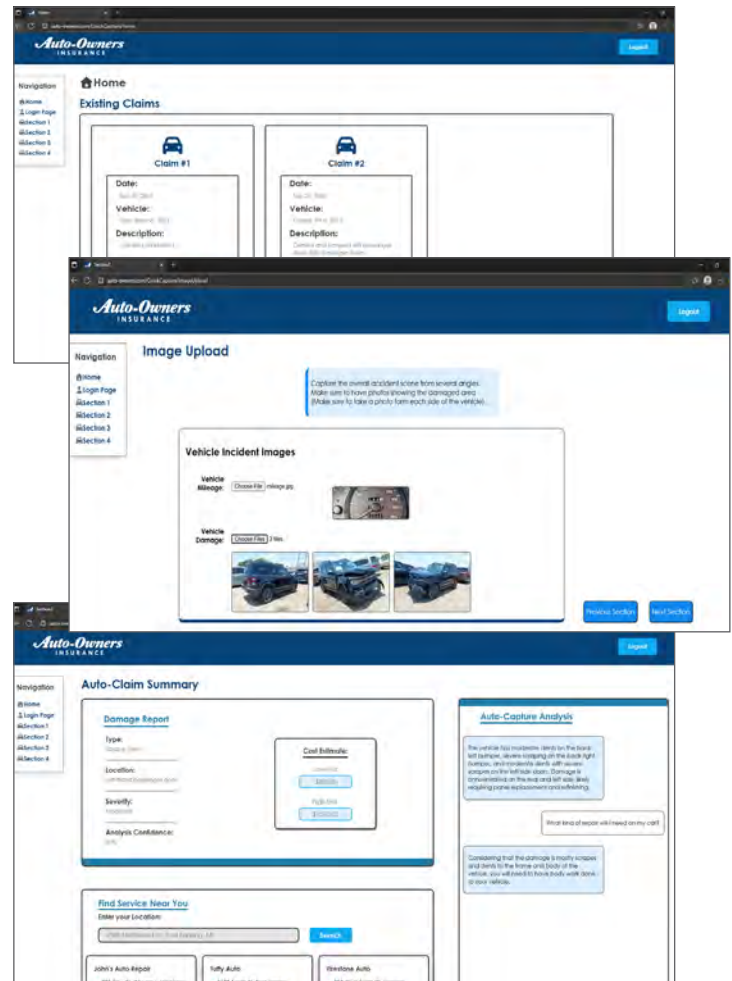
Insurance claims take time to process, which creates inefficiencies and additional stress for people after a crash. AO Quick Capture speeds up the experience with a simple, step-by-step flow. It helps policyholders obtain an estimate, repair options, and documentation about the damage in minutes.

Policyholders sign in, choose a policy and vehicle, confirm details, and upload photos of the damage. Our software analyzes the images, produces an instant repair estimate, and recommends next steps. It suggests nearby repair shops and assembles a shareable PDF report for adjusters and shops. An easy-to-use built-in chat assistant answers questions about coverage, documents, and next steps clearly and concisely.

AO Quick Capture's estimates reflect the visible damage in the photos and highlight items that may require an in-person inspection. The shop suggestions factor in distance and availability while reports summarize the estimate, link the selected shops, and capture photos set for later review. Policyholders can download the report immediately or access it later.

Our system reduces back-and-forth, sets expectations, and helps people make informed choices the same day as the accident. It saves time and stress for policyholders in an already tough situation.

The front end uses Angular 18 with HTML, TypeScript, and SASS. The back end uses Spring Boot (Java) with Microsoft SQL Server. Image analysis runs in Python with PyTorch, YOLOv11, and Gemini, while Google Maps supplies shop recommendations. The system is containerized using Docker.



Auto-Owners
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Corewell Health

An AI Tool for Enhancing Medical Education

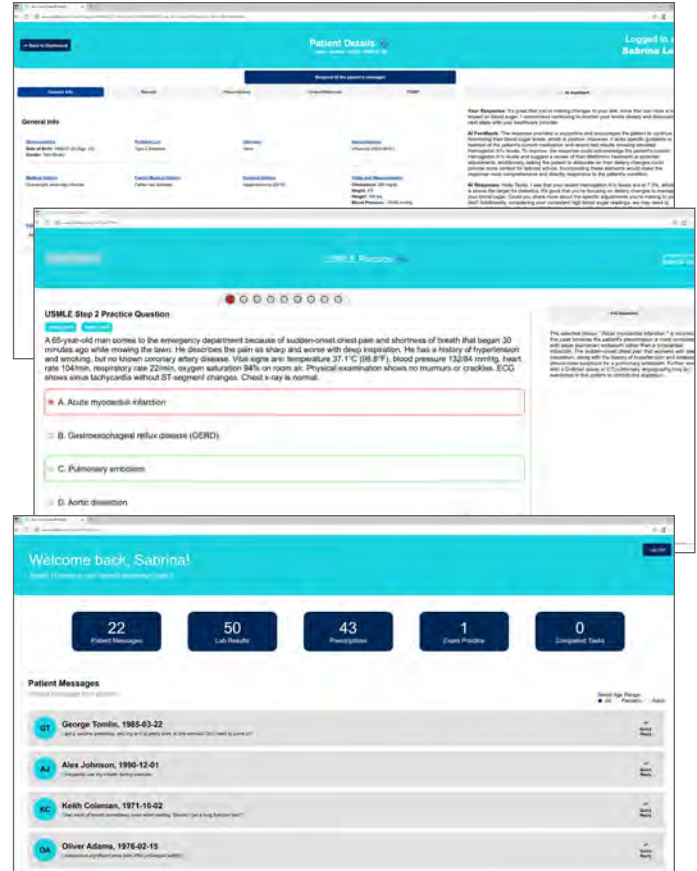
Corewell Health, originally formed in a groundbreaking 2022 merger between Spectrum Health and Beaumont Health, is Michigan's largest nonprofit health system. They currently operate 21 hospitals and 300 outpatient facilities while partnering with universities statewide to train future medical professionals.

Electronic health records (EHRs) and secure patient messaging are now fundamental components of modern healthcare. They enable physicians to quickly review test results, update charts, and communicate with patients. However, most medical school curricula do not provide structured training in how to use these crucial software systems. To close this gap, Corewell Health is expanding its simulated EHR platform, preparing students for the digital systems they rely on during residency and beyond.

Our AI Tool for Enhancing Medical Education integrates into Corewell Health's family medicine curriculum. The system generates diverse, realistic AI-generated patient cases built from national health datasets. Students interact with both adult and pediatric patients, order tests, and prescribe medications. An integrated order entry system mirrors existing EHRs, while AI-generated feedback highlights errors and reinforces correct reasoning. This process enables medical students to practice responding to patients in a realistic setting.

The platform also features an exam preparation page with AI-generated United States Medical Licensing Exam Step 2 questions, helping students strengthen diagnostic thinking and become more confident with exam formats. This ensures they are not only better prepared for testing but also more equipped to face the responsibilities of residency.

Our front-end software is written with ReactJS, and our back end is written in Golang. We use Flask and OpenAI's API for the LLM microservice, and our data is stored in a Supabase database.



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Delta Dental of Michigan, Ohio & Indiana AI Rule Metadata Generator

Delta Dental of Michigan is a dental insurance provider primarily serving the Tri-State area of Michigan, Indiana and Ohio. Through their business affiliates, they provide their services beyond the Tri-State area to millions of commercial clients, businesses, individuals, and government programs.

To service their millions of clients, Delta Dental hosts a database of business rules that contain business and dental-specific information. These rules are the building blocks of an insurance policy but often become unruly in their size and complexity. It is then difficult for Subject Matter Experts to obtain an organized and concise summary of these rules.

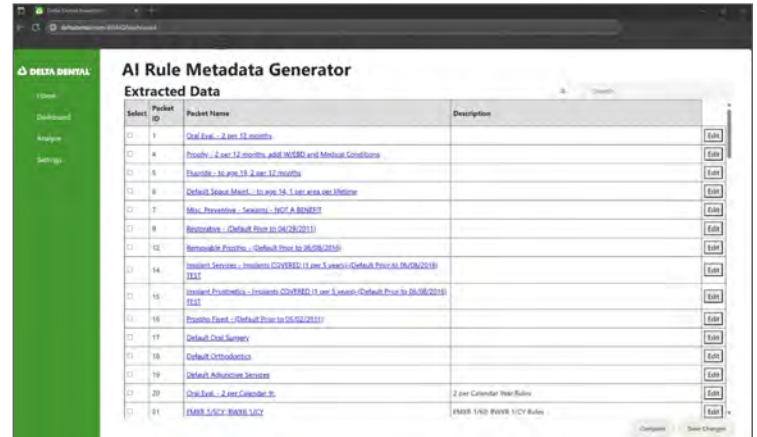
Our AI Rule Metadata Generator mitigates common issues that Subject Matter Experts often face by employing a state-of-the-art large language model that summarizes and builds robust metadata on these business rules.

The application is accessible through an easy-to-use web interface. The user navigates to the business rule of their interest – either through a manual lookup or by using our search feature – chooses up to four business rules, then clicks our “Generate” button.

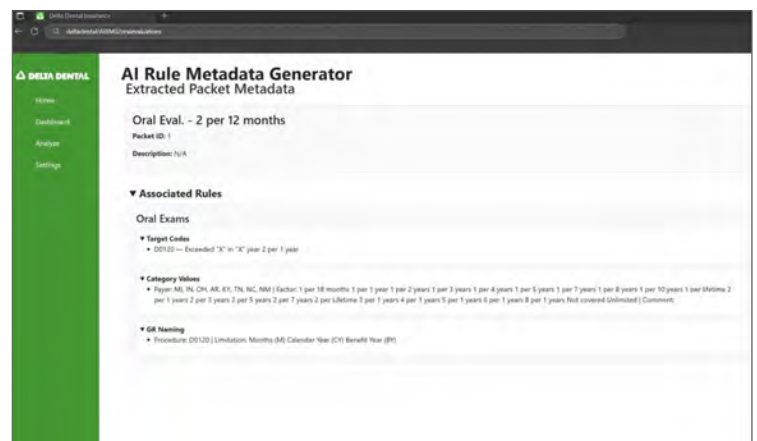
The chosen business rules run through the large language model, and a concise overview of the available and generated metadata is presented to the user in the web application. The user can edit anything they want and then download the generated metadata to use in their work.

Our tool streamlines the claims process by generating in-depth metadata for business rules. This helps Subject Matter Experts efficiently find and understand complex business information for a quicker and more accurate analysis.

The front end of our web application is built on Angular with a back end built on FastAPI, a PostgreSQL database, with an OpenAI large language model accessed through Azure Services.



Select	Packet ID	Packet Name	Description	Buttons
☐	1	Oral Eval... 2 per 12 months		Edit
☐	4	Prosth... 2 per 12 months, add 100% and Medical Conditions		Edit
☐	5	Excludes... to age 18, 2 per 12 months		Edit
☐	9	Default Special Maint... to age 18, 1 per year per Member		Edit
☐	7	Miss. Preventive... Services... NOT A BENEFIT		Edit
☐	8	Restorative... Default Prior to 04/28/2017		Edit
☐	12	Removable Prosth... Default Prior to 06/08/2018		Edit
☐	14	Insured Services... Insureds COVERED... 1 per 3 years... Default Prior to 06/08/2018		Edit
☐	15	Insured Prosthetics... Insureds COVERED... 1 per 3 years... Default Prior to 06/08/2018		Edit
☐	16	Prosth... Prost... Default Prior to 05/02/2017		Edit
☐	17	Default Oral Summary		Edit
☐	18	Default Orthodontics		Edit
☐	19	Default Adjunctive Services		Edit
☐	20	Oral Eval... 2 per Calendar Yr	2 per Calendar Year Rule	Edit
☐	21	EMERGENCY... RULE	EMER 100% BONUS 1 CY Rule	Edit



Select	Packet ID	Packet Name	Description	Buttons
☐	1	Oral Eval... 2 per 12 months		Edit

Oral Eval... 2 per 12 months
Packet ID: 1
Description: 1/4

Associated Rules

Oral Exams

Target Codes

- D0120 - Extended "X" or "C" year 2 per 1 year

Category Values

- Prosth... 2 per 12 months, add 100% and Medical Conditions

Old Naming

- Prosth... 2 per 12 months, add 100% and Medical Conditions



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Delta Dental of Michigan, Ohio & Indiana Insurance Quoting Assistant

Delta Dental provides dental insurance coverage to more than 83 million Americans. They are the largest dental insurance provider in the United States, saving their customers more than \$4.3 billion in just the past few years.

Creating over 80 million insurance quotes annually, Delta Dental tasks their underwriters with the creation of these quotes for prospective clients. Underwriters identify the manual and tedious data entry of client-supplied information to be the biggest pain point of this process. Due to the chaotic nature of this data and a wide range of possible formats, efficiency can be an elusive goal.

Our Insurance Quoting Assistant solves this by analyzing and parsing a wide variety of client-supplied files and automatically creating proposals, thereby streamlining the underwriting process.

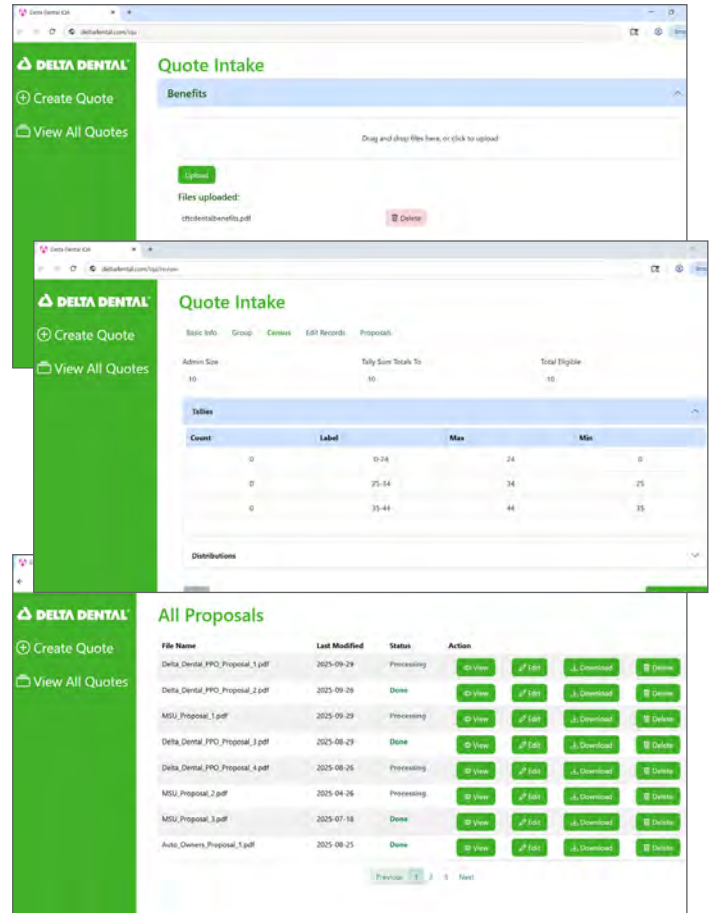
The web application lets an underwriter upload a wide variety of files and to review automatically generated sections of the quote through an intuitive and easy to use UI. Once the underwriter reviews and makes the necessary additions, the web application generates a proposal document for the client.

If changes are requested, seamless version tracking and editing capabilities aid the underwriter in accommodating, while the search feature enables efficient retrieval of these different versions.

Our application streamlines the underwriting process by enabling underwriters to gather and review information to generate quotes at an unprecedented rate.

Even using a very conservative estimate the tool saves around 200 hours of work time a year and likely more for some of the more difficult quotes.

The front end of our web application is built with Angular and Bootstrap. Python FastAPI serves as the AI microservice. MongoDB provides the database. The Java Quarkus back end connects all these components together.



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General Motors Habitat Identification Using Drone Imaging

General Motors (GM) is a global company that has grown to become one of the largest and most recognizable automotive brands in the world. Founded in 1908 by William C. Durant, GM has established itself as a powerhouse within the industry, and has since expanded into various fields, such as Auto Loan Finances, Defense, and Software.

GM has a longstanding history of protecting natural resources, minimizing environmental impact, and preserving the biodiversity across its operations worldwide. The company is now exploring new ways to efficiently identify and monitor species at its sites.

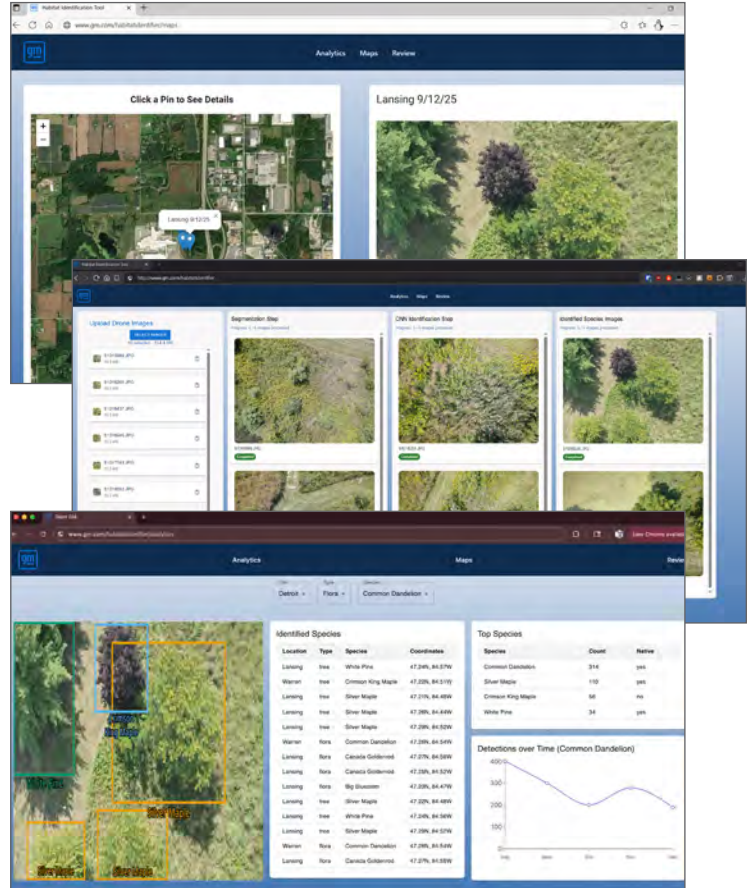
Our Habitat Identification using Drone Imaging Tool makes it easier to map and log plant species more efficiently through an intuitive web application.

When a user provides drone imagery of a habitat, the images are processed by a machine learning model that detects and classifies different plant species. The results of the model are stored in a database and displayed through an easy-to-read and interactive UI.

The application also supports continuous model learning by enabling users to confirm or correct the model's outputs. This means the model not only improves over time but also learns to classify unknown plant species through user feedback.

Our application efficiently reads drone imagery and identifies the different plant species present within the habitat. It provides the experts at GM a tool for tracking plant species abundance and diversity over time.

Our Habitat Identification using Drone Imaging Tool is built as a web application using a React together with TypeScript front end. The back end built on Flask with Python. The machine learning model is developed using Segment Anything Model in combination with the ViT to detect and segment plant species. PostgreSQL is used to store the data from the drone footage and model.



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HAP

Mastering AI Prompts: HAP Prompt Yielder (HAPpy)

Health Alliance Plan is a health insurer based in Detroit, Michigan that provides coverage for both individuals and businesses of all sizes. HAP serves over 430,000 members across the state of Michigan. By sponsoring innovative projects, HAP supports the development of tools that make technology more accessible. Artificial intelligence is a technology sector that is rapidly evolving and is becoming an essential tool in the workplace. However, many users struggle to write effective prompts. Without clear guidance, they risk vague or low-quality results from artificial intelligence systems.

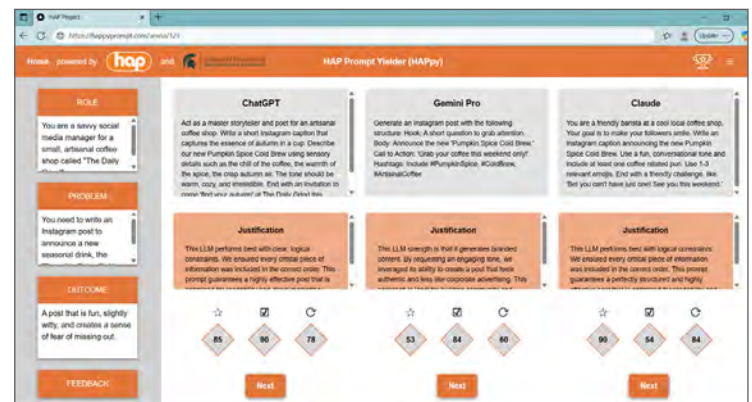
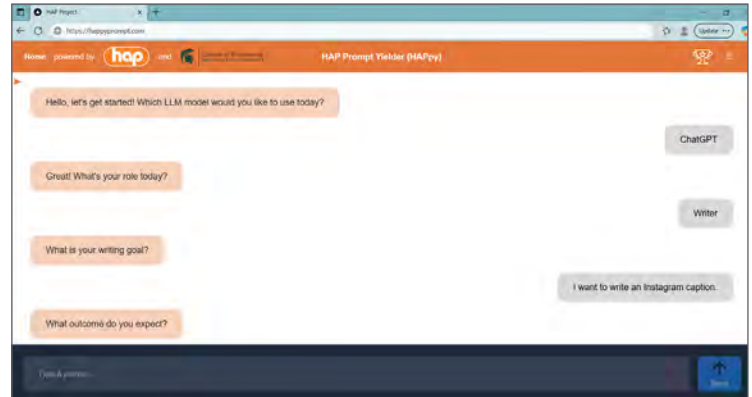
HAP seeks way to improve users' prompt engineering skills by creating technology that is accessible to anyone.

Our HAP Prompt Yielder (HAPpy) software is an automatic prompt generation tool usable by anyone. By breaking down the components of a strong prompt, our system helps users craft better instructions for large language models like ChatGPT, Claude, Gemini Pro, and more.

The system provides a live, prompt quality scorecard which contains three different categories on how a prompt is evaluated. Based on the user's role, they can interact with the system in a chat-like manner and receive a final prompt. From there, the user is redirected to a page recommending top large language models. Their outputs are displayed and easily viewable for comparison. Users can give feedback to improve the scoring model, making the tool smarter over time.

Our software speeds up prompt generation, improving productivity and saving time, resulting in happy users.

HAPpy is built with a React and Next.js front end hosted on Vercel, a Python FastAPI back end deployed on Render with a database layer, and Supabase managing PostgreSQL storage for data and user feedback.



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Henry Ford Innovations Electronic Laboratory User's Guide (eLUG) 2.0

Based in Detroit, Michigan, Henry Ford Health is a leading health system and academic institution that has brought clinical innovation and research to healthcare since its beginnings in 1915. With over 50,000 team members, 13 hospitals and 6,000 research projects per year, Henry Ford Health is dedicated to making breakthrough discoveries to innovate healthcare and improve outcomes for all patients.

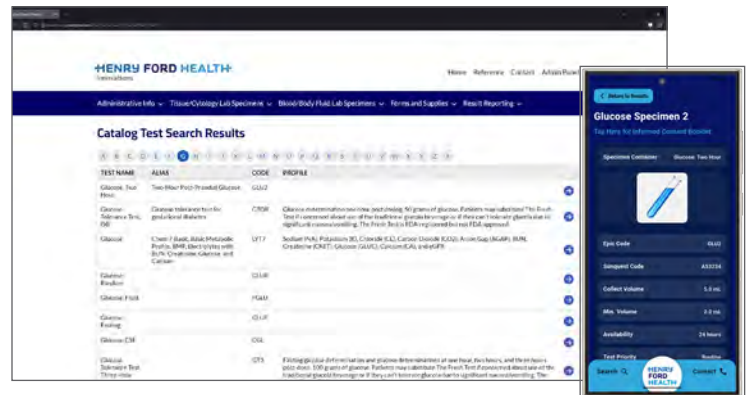
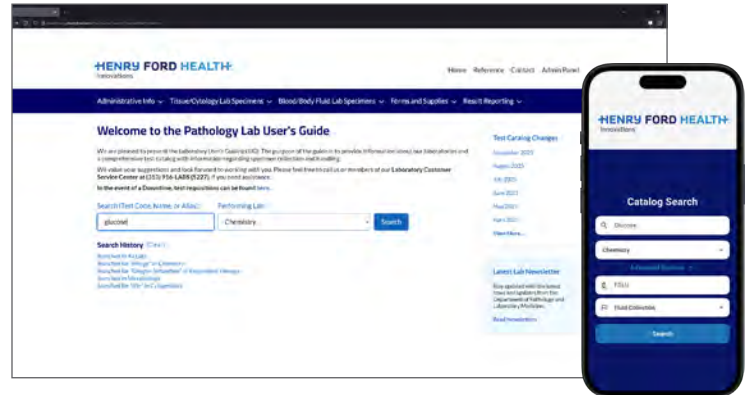
For Henry Ford Health's Department of Pathology, clearly defined and accessible testing procedures are critical. The software they use to achieve this is their Electronic Laboratory User's Guide (eLUG). The eLUG features a lab testing catalog with information on collection instructions and specimen submission requirements for specific tests.

The eLUG's existing web application has not had a major overhaul since 2003, necessitating a modern design for both improved usability and maintainability.

Our new eLUG 2.0 software provides clinicians and staff with improved usability through a completely redesigned user interface and a cross-platform mobile application. The improved maintainability comes from a new database structure with increased integration.

Security is vital for healthcare systems. To secure the applications, the eLUG 2.0 boasts a management utility that uses multiple layers of permissions to restrict access to certain data. This requires that users be internally authenticated to perform specific tasks, keeping Henry Ford data private and secure.

Our web application is built using a Windows Server technology stack. The front end consists of dynamic HTML pages, CSS and JavaScript. The back end uses Microsoft IIS and PHP, connected to a Microsoft SQL Server database. The mobile app uses the same back end, but with Flutter as the front end.



HENRY FORD HEALTH
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Kohl's Kohl's Cash Hero

Kohl's is a Fortune 500 company that provides for families across America at over 1,100 stores in 49 states, as well as at Kohls.com and through the Kohl's App.

Kohl's proudly serves over 60 million customers and is always looking for ways to improve. In pursuit of this, Kohl's searches for various strategies to engage new and long-time customers alike. Younger consumers respond well to systems that encourage daily streaks and intuitive user interfaces.

Our Kohl's Cash Hero encourages shoppers to use the Kohl's website while also providing a new way to discover the Kohl's catalog.

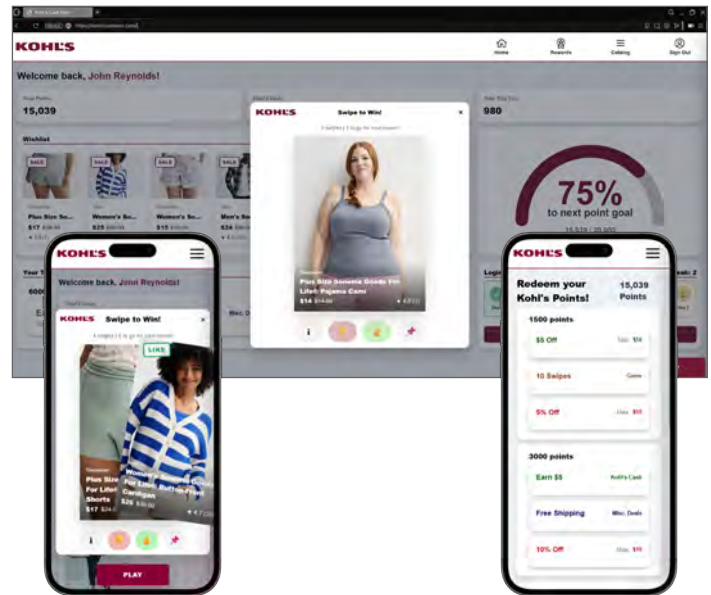
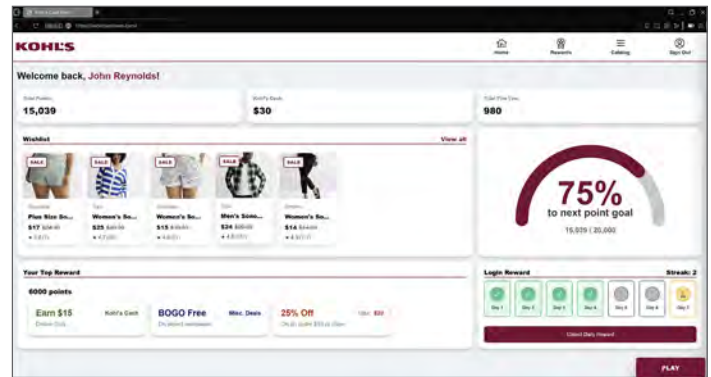
Instead of the shopper walking through a store or scrolling through Kohls.com, our system brings the product to the shopper. Shoppers are shown a series of products that our system predicts will interest them. With a simple swipe, a user can signal interest in eye-catching items as well as add them to a wish list. Our web app automatically learns user preference and taste, recommending more appropriate wares.

Our system rewards players each day that they swipe with guaranteed in-game points, which shoppers can use to redeem coupons. Consecutive days of use starts a streak for bonus points.

The information our system provides to Kohl's also helps them better serve customers by revealing trends and consumer tastes using insight not provided by sales data alone.

Our software increases customer retention and encourages them to shop at Kohl's, improving customer loyalty and increasing revenue.

The system uses React on the front end and Spring Boot on the back end. Axios handles communication between the two, and product information comes from a Microsoft SQL database hosted by Azure.



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Launch by NTT DATA

My VR Language Tutor

Launch is a technology solutions company and division of NTT Data, a top 10 global IT provider. Launch provides dynamic, long lasting digital solutions for companies, such as Epic Games and Ford, who look to deliver scalable and competitive products at high speeds.

Many language learners struggle to learn a new language through rote memorization and rigid conversational templates. Limited experience leads many to feel unprepared when they have the opportunity for a real-life conversation.

My VR Language Tutor is a virtual reality application that provides users with an immersive language-learning experience powered by artificial intelligence, bridging the gap between learning a language and putting it into practice.

Our software includes vibrant environments populated with objects, signs and characters that simulate real-life language use cases. Users explore at their leisure, conversing with the characters and interacting with the environment.

Users build vocabulary by identifying objects and receiving feedback. To improve pronunciation, users read signs aloud and receive a grade based on their performance. Speakers improve natural conversation skills by chatting with characters about topics relevant to the environment.

To cater to learners of all skill levels, multiple levels of proficiency are supported. Additionally, hints and assistance can be toggled.

Our software is built for the Meta Quest 3 headset utilizing the Unity 6 game engine. The back-end services utilize C# and Python with an AWS hosted FastAPI system. The Microsoft Azure AI Foundry and an OpenAI integration are utilized for natural language processing tasks including translation, transcription, speech synthesis and language generation.



Launch

by NTT DATA



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Ludus

Web-Based FGL Ticket Emulator & Interpreter

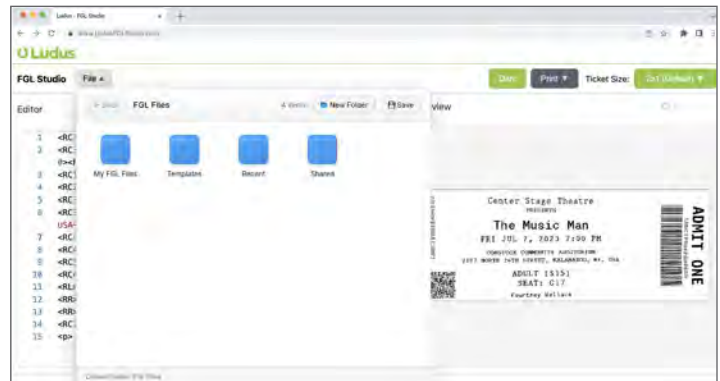
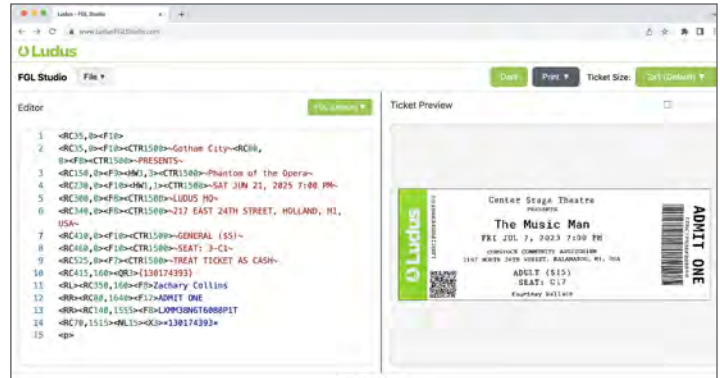
Founded in 2016 by a student and theater director duo, Ludus is a company made for thespians, by thespians. Ludus is a software-as-a-service (SaaS) company based in Holland, Michigan which has grown to support more than 4,500 organizations in creating incredible experiences for venues across America, providing solutions in ticketing, marketing, fundraising, volunteer management and much more.

The primary solution Ludus provides is digital ticketing. However, Ludus also prints physical tickets for their clients who desire a more analog ticketing experience. Physical ticket printing is carried out through the industry standard BOCA printers, which do not ship tools for ticket creation. Instead, designers configure tickets in FGL code, a highly technical language that is over 15 years old, and with matching development software. Ludus' vision is to bring FGL into the modern web-based world.

Our Web-Based FGL Ticket Emulator ushers users into that bright future, through easing the creation and design of tickets, with the ability to preview designs prior to printing, which was never possible before. It provides a clean interface familiar to users of other technical languages, including features such as syntax highlighting, automatic text prediction, error checking, validation and, most importantly, instant ticket printing.

The emulator also supports real-time previews of the ticket as it is being edited as well as access to the whole corpus of FGL features. These include 13 different fonts, barcodes and various layout adjustments. With access to all these features, ticket design time is reduced from hours to minutes.

The application runs as a web app built with React, separated into a parsing package which validates the FGL code alongside a high-performance rendering package written in TypeScript using low-level HTML5 canvas API calls for precise, fast output.



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Magna

ML/AI Pipeline for Condition-Based Maintenance

Magna is one of the world's largest automotive suppliers, recognized for their scale, reliability, and innovations across the entire automotive industry. They are committed to maintaining the highest standards of operational excellence and industrial leadership.

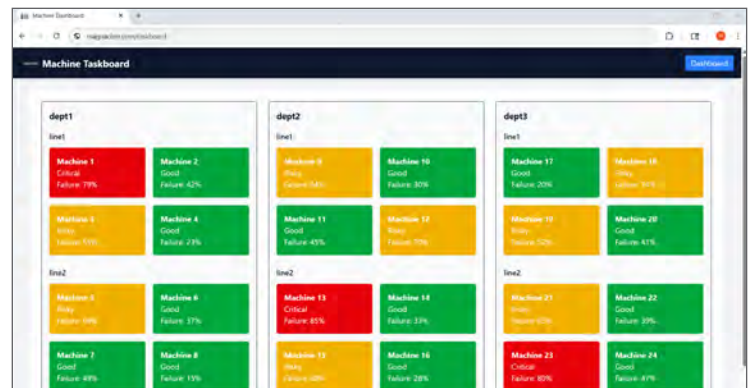
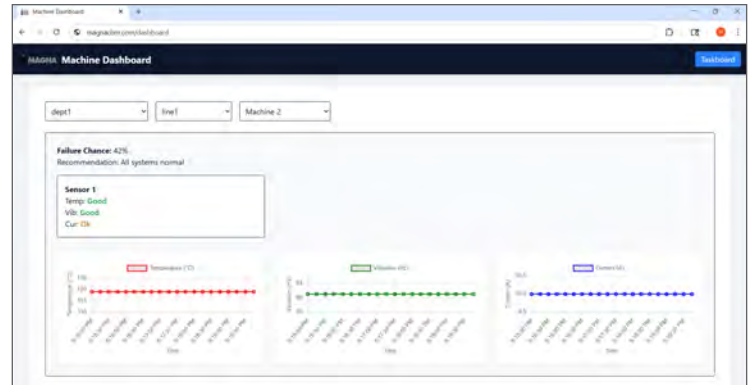
Unplanned equipment downtime is a major challenge in manufacturing, leading to financial losses and reduced productivity. Traditional maintenance—reactive or fixed-schedule—often prove inefficient. A better solution is predictive maintenance, which anticipates failures before they happen, saving costs, optimizing production, and extending equipment life.

Our ML/AI Pipeline for Condition-Based Maintenance provides a complete system that monitors equipment health in real time and predicts future failures. Our software uses machine learning to collect and analyze sensor data from industrial machinery. The system identifies subtle changes in a machine's performance, leading technicians to address issues proactively.

Our system presents live sensor readings, historical trends, and predictive alerts through an intuitive dashboard. Each machine equipped with sensors has a dedicated page displaying all attached sensors and their current data readings. The interface also highlights any readings that are abnormal or potentially concerning for quick identification and response.

For each machine, the system displays the projected probability of failure within the next 30 days to help maintenance operators determine when maintenance should be performed.

The front end of our condition-based maintenance system is built with React, while the back end uses Next.js and stores data in a PostgreSQL database. The ML/AI pipeline is implemented in Python using ROS 2, with sensor data transmitted via the MQTT protocol.



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Magna

LLM 3D Model Interpretation & Decomposition

Magna is the leading supplier in the automotive industry, with operations in more than 28 countries and over 100,000 employees. They design and manufacture advanced systems found in nearly every major automotive brand. Magna's vision is to continue advancing mobility for everyone and everything.

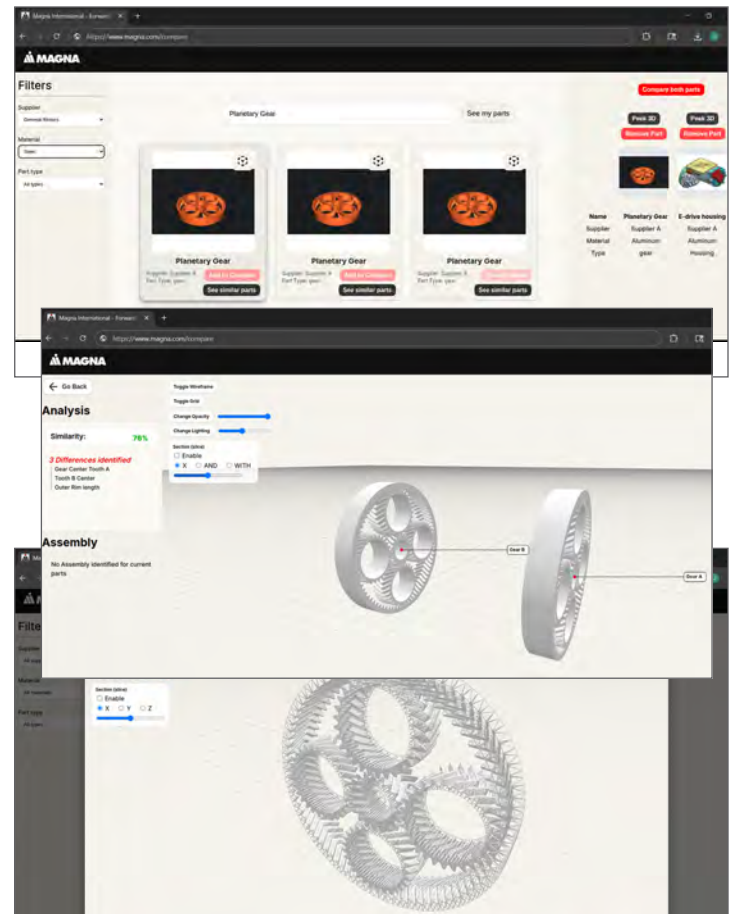
Magna relies heavily on a wide array of component models. These components exist in many variants across different suppliers. Engineers must view, examine and compare the models to further develop their products. This task is slow and difficult to complete, especially as the scale of models increases.

Our LLM 3D Model Interpretation and Decomposition tool eliminates the slow and tedious process of analyzing these component models. The system automatically interprets 3D models, decomposes them into meaningful sections, and generates clear descriptions of each part and its structure. Variants are placed side by side in an interactive three-dimensional viewer where key differences and similarities are highlighted in real time.

Engineers can also query for specific parts using a natural language query through plain text, removing the need to filter and search through thousands of models, turning hours of work into mere seconds. Users can find any part based on any criteria such as material, supplier, or even a specific functionality of the part.

Our system streamlines the automotive component comparison process, saving time and money.

Our LLM 3D Model Interpretation and Decomposition tool is developed as a Python-based pipeline with Open3D geometry processing, vector storage through Neo4j, and an AI-powered FastAPI back end. The results appear in a responsive web application with visualization powered through Three.js, for detailed analysis.



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VR Human-AI Multimodal Interaction

Magna International is a leading global automotive part supplier. By utilizing its 158,000 employees, throughout 342 manufacturing operations, across 27 countries, they foster innovation and push the boundaries of sustainable auto-production.

Computer-aided design (CAD) is the industry standard for creating 2D and 3D models. Due to the rising level of proficiency required for production-level CAD, modeling is typically restricted to highly experienced users.

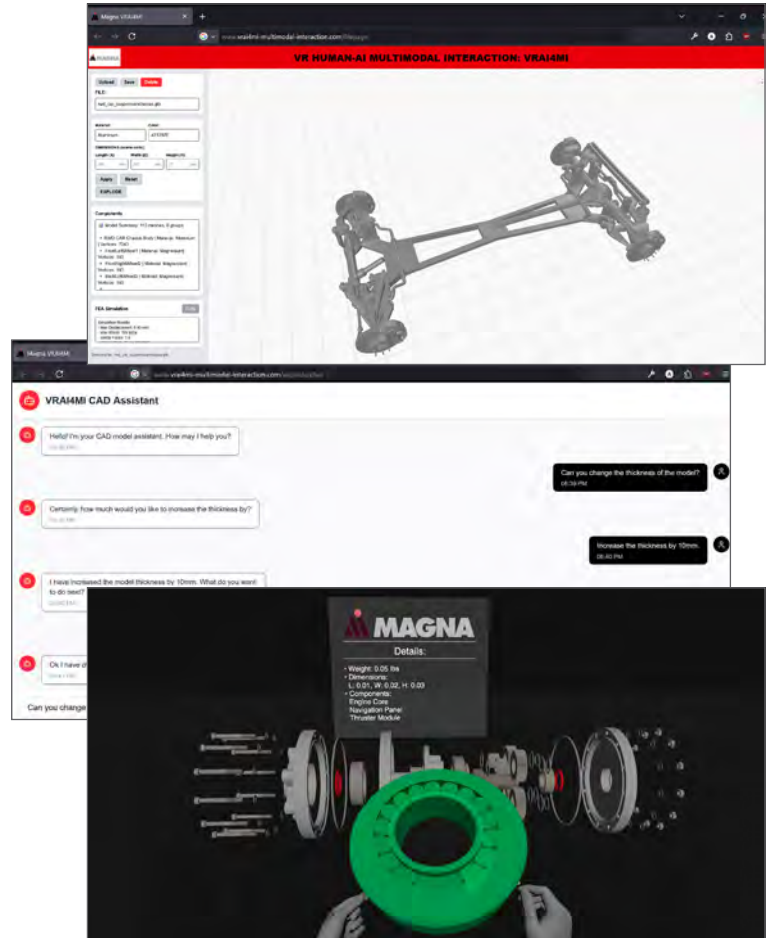
Our VR Human-AI Multimodal Interaction application empowers less experienced users by enabling advanced CAD operations through human-AI interaction. This vastly simplifies the design process and minimizes the CAD expertise required for advanced modeling.

Users utilize speech commands paired with interconnected AI models to invoke both specific and general object manipulation. Existing models can be quickly edited with a single sentence to meet new specifications. This bypasses the elaborate manual design process, enables engineers of varying design experience, and reduces production time.

Engineers and designers interact with their models in a 3D environment using virtual reality. Simple hand gestures and voice commands are used to manipulate and edit the model.

Our application bridges the gap between advanced and intermediate CAD designers by applying cutting-edge agentic technologies, saving time spent designing CAD models.

The front end of our VR Human-AI Multimodal Interaction is built using CSS, HTML and Next.js, while the back end is implemented using Typescript, Python and Node.js. They interact with one another through artificial intelligence reliant services such as OpenAI, FreeCAD MCP and Azure Blob storage.



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McKesson

Intelligent Network Security for High-Risk Traffic

McKesson is a Fortune 10 healthcare company that distributes pharmaceutical supplies and provides patient care across the world. By integrating technology services into healthcare, McKesson emphasizes the importance of patient outcomes.

To protect sensitive data and prevent interferences in crucial operations, healthcare industries rely on secure cybersecurity initiatives. Organizations rely on firewalls to prevent malicious actors from gaining access to their network. A firewall rule is a directive for a firewall which controls the network's traffic. Detecting vulnerabilities in firewall rules is essential to maintaining a secure digital environment.

Our Intelligent Network Security for High-Risk Traffic system provides an interactive and convenient way for McKesson employees to view and mitigate firewall rule risks and threats.

Our intuitive web interface enables business and technology owners to manage firewall rules that relate to their applications. This authorizes managers to assign rules to their subordinates, making sure they are monitored in case of threats, while also regulating their own rules.

The system relies on a risk engine which analyzes attributes of firewall rules to determine their vulnerabilities. When suspicious behavior or anomalies are detected with our risk engine, alerts and attestations are sent out to the rule's owner, prompting them to act against these threats.

The webpage includes a dashboard that monitors rule usage and risk trends over time. The data is stored in a secure database which is integrated with the webpage through visualized graphs and charts that are easy to read.

The application is constructed using Python and Flask as the back end and PostgreSQL as the database to analyze firewall rules. The front end is built with React and Power BI.



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Meijer

Environmental Awareness with BeBot

Meijer is a prominent supercenter chain in the Midwest, headquartered in Grand Rapids, Michigan. They have over 270 locations across six states and have partnered with the Great Lakes Cleanup Program, an environmental non-profit, to increase sustainability and give back to the community.

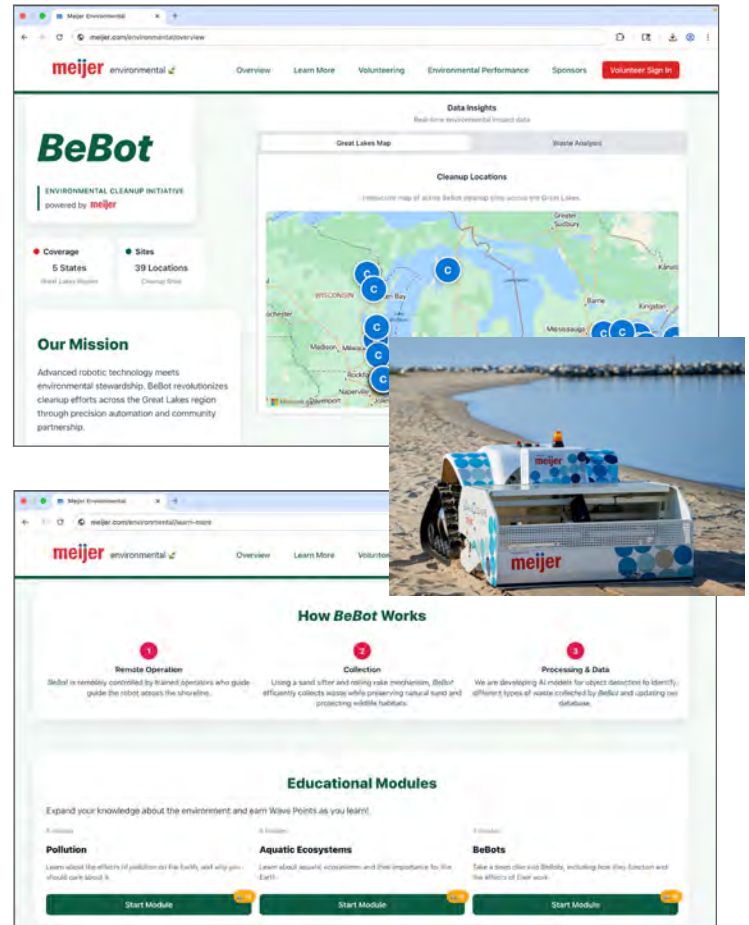
Over the past several years, Meijer's sustainability efforts have intensified and expanded to Michigan's beloved beaches. Meijer has purchased and named BeBots, beach cleaning robots that sift through sand for waste collection, which have been carrying out cleanups around the Great Lakes since early 2025.

Environmental Awareness with BeBot is a web-based application that builds community engagement with Meijer's sustainability efforts. The core features include real-time graphs and other easily digestible data visualizations that inform users about how Meijer's BeBots are helping the environment. Integrated educational modules about a range of topics provide a solid foundation of why cleanup initiatives are so important and what Meijer is doing to contribute.

The site also features a gamified point system. Completing educational modules awards users with points, called Wave Points. A signup portal acts as a hub for individuals and organizations to volunteer for cleanup events across the Midwest, also awarding Wave Points. A sponsor portal enables organizations to support Meijer in its environmental mission.

Our Environmental Awareness with BeBot fosters public engagement and raises awareness of Meijer's green-initiatives.

The front end of uses ReactJS, with a back end utilizing Java with Spring Boot, and Azure Custom Vision. The platform is hosted on Microsoft Azure. Data is managed through an Azure SQL database, and Power BI dashboards provide real-time graphics of trash cleanup efforts around the Great Lakes region.



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Remote Interface for Small-Scale Autonomous Racecars

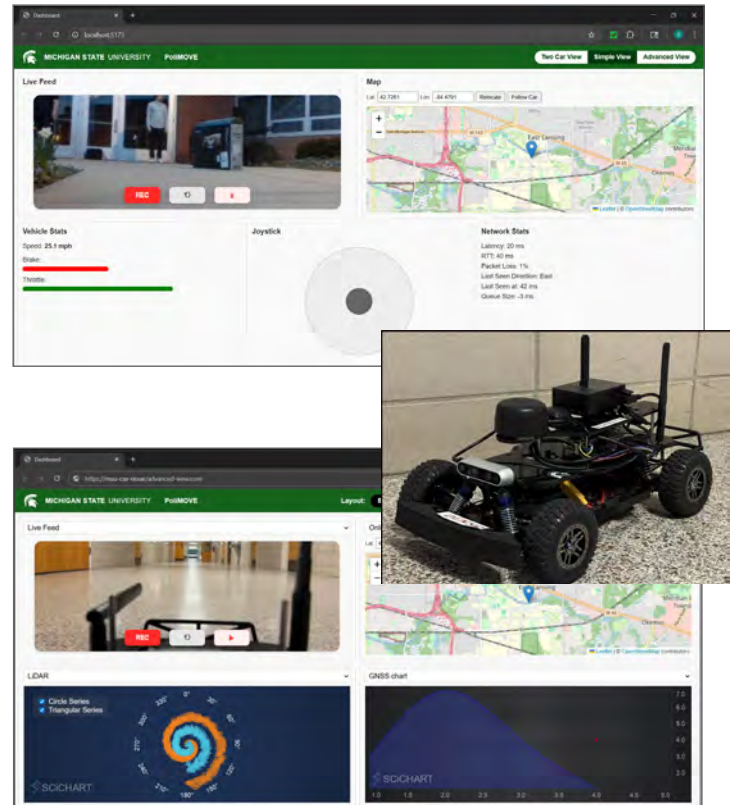
The PoliMOVE-MSU team, a collaboration between Michigan State University and Politecnico di Milano, is a fierce competitor in the Indy Autonomous Challenge. The team has won first place in the competition multiple times and has set several world records, demonstrating just how impressive and versatile their skills are.

To best navigate environments and avoid expensive crashes when racing, autonomous vehicles need to be trained and tested on real-world sensor data. To capture data accurately, the PoliMOVE-MSU team utilizes a small remote-controlled car equipped with sensors, enabling the team to gather data without putting a full-scale car at risk. Unfortunately, the team currently does not have an easy way to control and receive data from the vehicle.

The Remote Interface for Small-Scale Autonomous Racecars assists with both research and community outreach, enabling both in the same easy-to-use web application. With our software, the user can operate the remote car while seeing real-time sensor data from the car, which is continually recorded and saved for efficient use in training. Furthermore, our software creates a realistic and safe environment for children to operate the vehicle, educating them about autonomous vehicles in a hands-on environment.

Our web application has three different views the user can choose from. The simple view shows less data but enables driving the car right from the touchscreen for easy demonstrations, enabling children to operate the vehicle via a touchscreen computer or tablet. The advanced view enables customizable sensor displays, ensuring researchers can track every sensor they need. The two-car view supports driving two cars simultaneously, so multiple users can work on the same instance of the application.

The front end of our software is written in ReactJS while the back end is built with Flask and Python. Communication with the car is handled using ROS2 middleware.



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Michigan State University Citing Slavery Data Presentation

The Citing Slavery Project, spearheaded by Michigan State University professor Justin Simard, acknowledges and discusses the modern citation of slave cases. Modern court cases continue to cite slave cases as precedent, legitimizing slavery by fitting cases involving enslaved people into standard legal categories.

Modern legal databases are complex and difficult to navigate, requiring researchers to spend time and energy searching for the right cases. Our software renovates the current system, bringing a fresh look as well as implementing robust searching strategies used by educators, students, lawyers, and the general public.

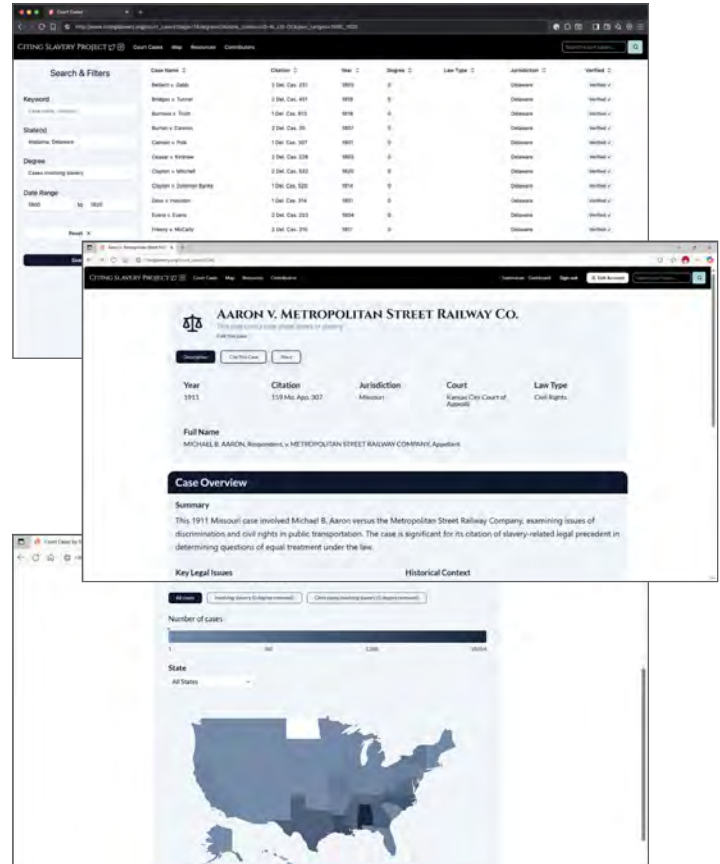
Our Citing Slavery Data Presentation website focuses on making slavery court case data accessible by offering a simple, easy-to-use website. Our site is modern and approachable to anyone, including users with disabilities.

The site's key attribute is its universal search feature, located at the top of every page. Extensive filtering options are achieved via the court case table page, enabling users to organize thousands of court cases by various criteria.

A major concern of the Citing Slavery Project is the accuracy of citing cases as many historic cases contain inaccurate citations, causing associations between invalid cases. The website automatically verifies each court case, flagging all that require approval by law students or professionals. Furthermore, the Project provides case summaries that exclude complex legal jargon so users can understand the importance of each case.

Our website works on any device with a web browser, including mobile devices and computers.

Our front end is written in SvelteKit, the back end is written in Ruby on Rails, and data is stored in a PostgreSQL database. Our software is hosted via Railway. The project utilizes OpenAI embeddings for semantic searching and case summaries.



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MSU Federal Credit Union AI-Powered Financial Wellness Coach

MSU Federal Credit Union (MSUFCU) has been serving Michigan State University and the greater Lansing area since they were established in 1937. MSUFCU has a mission to help both local communities and those beyond to reach financial freedom with 35 branch locations across the Midwest and over 367,000 members.

Currently, many young professionals, students, and financially vulnerable people manage money without clear guidance. Budgeting effectively feels confusing, noisy, and the next best step isn't always obvious. Members find it difficult to identify financial patterns and build confidence. As such, MSUFCU is looking to provide a seamless assistant to help members see financial patterns, set a plan, and follow it with confidence.

Our AI-Powered Financial Wellness Coach turns everyday financial activity into clear personal guidance and support. Using plain language, the coach responds to members with high quality answers and helpful information. Members simply ask questions such as, "How was my spending history this month?" and can receive spending breakdowns, set savings goals, and visualize their finances.

When members reach goal milestones with real-time tracking, the coach automatically notifies the member about the milestone and offers simple next steps to continue the momentum. Similarly, members can set budgets with the coach and receive real-time feedback that helps them stay on track with their spending.

With the AI-Powered Financial Wellness Coach, MSUFCU helps their members build the financial future they want.

Our Financial Wellness Coach utilizes a front end built with React for web and mobile, and a back end built with Python, PostgreSQL, and OpenAI API. A Model Context Protocol server is the middleware that securely connects the agent to simulated banking information.



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NetJets

Weather Monitoring and Impact Assessment

NetJets is the global leader in private aviation, operating a fleet of over 700 private jets. NetJets is at the forefront of the fractional ownership model, providing its customers with luxury flights from thousands of airports.

Weather patterns, such as thunderstorms or hail, often bring about risks on aircraft efficiency and safety. Keeping track of these constraints can be difficult for NetJets personnel to manage and plan around.

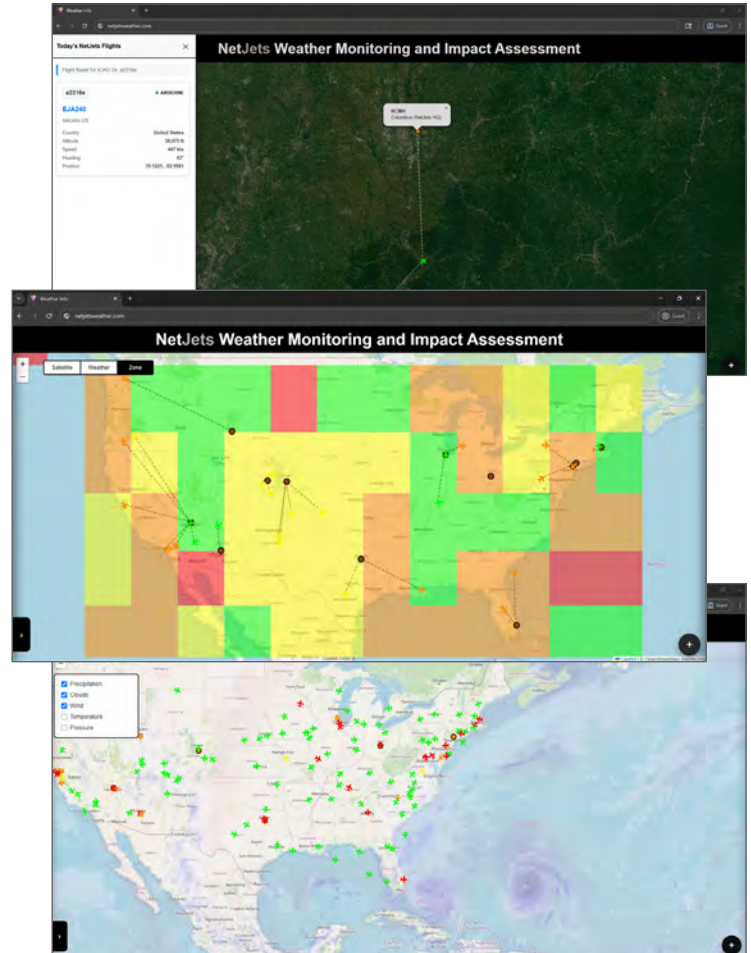
Our Weather Monitoring and Impact Assessment tool is an interactive web application that enables users to view NetJets aircrafts and weather phenomena as they are in flight. Our system enables operators to see the critical factors that may impact flight safety such as heavy rain and high wind speeds.

Our program gives users the option to view different map types depending on what they are looking for: world map view, a weather view with toggle options to see weather in real time, or a risk zone view to assess risky areas determined by weather factors.

Each plane is assessed by flight path to determine the risk it is in. If the flight path is near or within a severe weather event, the flight is colored to match the risk level of the event.

For greater analysis on impact assessment, our tool provides a historical record of previous NetJets flights. The NetJets operational team can view unprecedented weather events in the past and understand what may have caused damage to their planes. This enables NetJets personnel to determine methods that may help minimize these risks in the future.

The front end of the Weather Monitoring and Impact Assessment system is built using ReactJS, while the back end transfers data to and from DynamoDB. The program is hosted on Amazon Web Services. Flights are drawn from OpenSky and weather is drawn from OpenWeather.



NETJETS®



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PACE of Southeast Michigan AI Services & Vendor Navigator

PACE of Southeast Michigan is a healthcare provider that offers comprehensive, all-inclusive medical and wellness support for elderly residents. PACE provides Medicare- and Medicaid-covered services, as well as a broad range of other services that are medically necessary for a patient's health. This includes at-home healthcare, mental health services, and even transportation.

For services PACE does not provide in-house, the interdisciplinary team coordinates with a range of outsourced vendors, including hospitals, specialty clinics and medical equipment providers, aligning with the patient's needs.

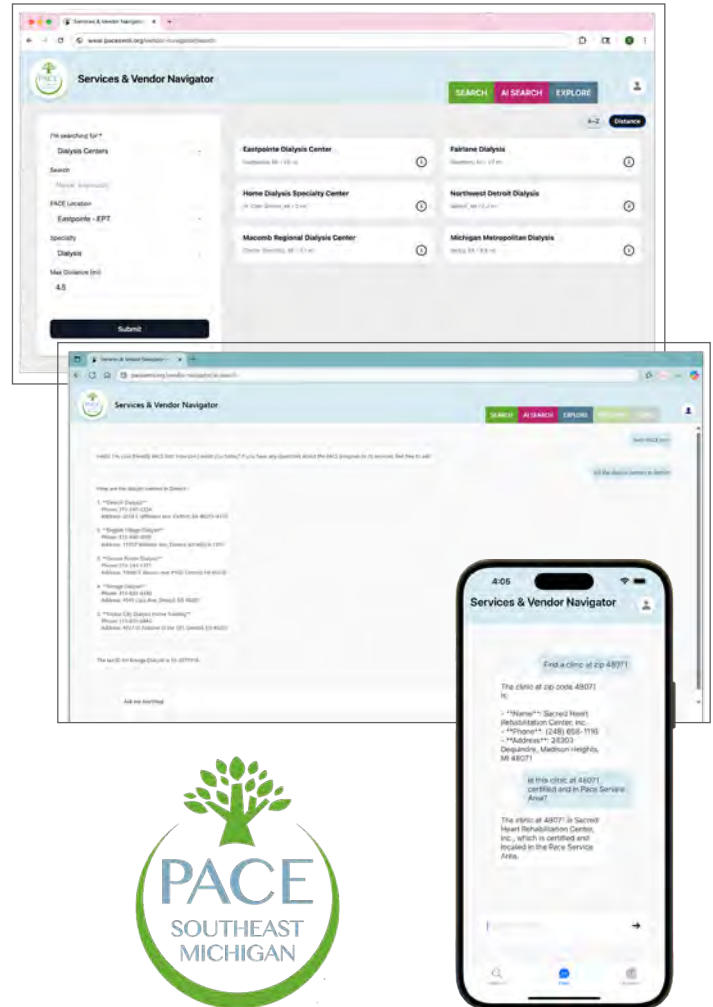
Our AI Services and Vendor Navigator helps PACE employees quickly retrieve vendor and service information through an easy-to-use web and mobile app.

Our software enables employees to ask questions in a chatbot interface and receive clear and accurate answers from a centralized database. Using this information, they can explore and compare vendors to better support PACE members' healthcare needs.

In addition to the AI chatbot, the application enables employees to directly search through the database. They can filter search results by different fields, including by vendor name, location and specialty. They can also further refine the results by distance to a PACE site to get the most relevant search results.

The application includes an additional admin page for data management, allowing administrative users to add, edit, and remove vendor data. This page helps keep vendor and contract information up to date, ensuring that elderly residents get the quality care they deserve.

The front end of our software platform utilizes React Native for mobile and web compatibility. The back end is built on Flask using Python with PostgreSQL managing the vendor database and OpenAI API powering the conversational interface.



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Stryker

Clean & Sterilized Instrumentation

Stryker is a global leader in medical technologies, offering innovative products and services to improve healthcare for patients globally, influencing over 75 countries serving over 150 million patients.

Hospitals around the world have Sterile Processing Departments (SPD) for sanitizing and packaging tools used in Operating Rooms (OR). When packaging tools in the SPD sometimes tools are broken, soiled or missing and go unnoticed. By the time those tools are found in the operating room, it costs valuable time and money to replace them.

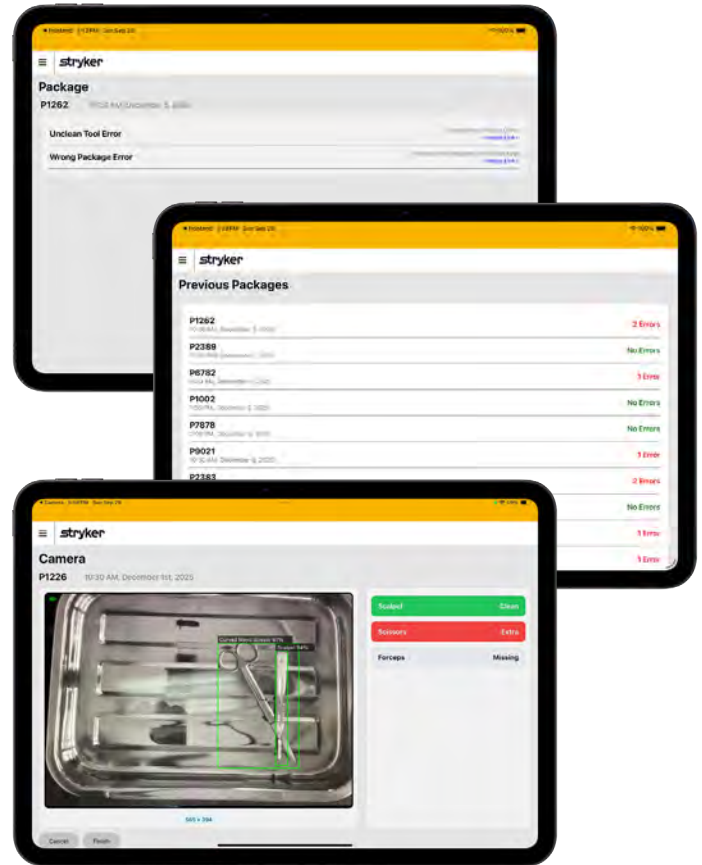
Our Clean & Sterilized Instrumentation application mitigates this issue by monitoring tool packaging within the SPD and notifying SPD technicians of any unclean tools.

On the home page, SPD technicians select what package they are fulfilling, progressing them to the camera page that utilizes the device camera to monitor the packaging of tools. The application knows what tools are required within the package and identifies tools that are broken, soiled or missing. Technicians are required to fix any issues our software finds before moving on, ensuring minimal waste of time and resources.

The OR Manager has access to all previous packages filed by SPD technicians under their management. The application tracks how many errors it finds, calculating the time and money saved by catching those errors at the SPD stage.

Our software automatically tracks tools and their usage from operation to sterilization and packaging, reducing time spent searching and improving patient safety.

Our application uses React Native, JavaScript, TypeScript, and Swift for the front end. The back end is powered by Python and FastAPI, with the AI model implemented with YOLO and PyTorch. Package and Tool data is hosted on a PostgreSQL server.



stryker



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TechSmith

Insight Weaver AI (IWAI)

TechSmith's mission enables users to communicate and share their message through media capture and editing software. Founded in 1987, TechSmith's products, notably Snagit and Camtasia, are employed by over 70 million users worldwide and all Fortune 500 companies.

Video editing can be time-consuming and difficult to learn. Many people are unfamiliar with video editing applications and lack the time to learn them. Inexperienced video editors often face the problem of transforming screen recordings, presentations, and webcam footage into professional and engaging videos.

To combat this issue, our Insight Weaver AI (IWAI) web application enables users to upload their footage to be edited by our Agentic AI systems. Our software transforms the provided footage into three polished and cohesive videos to choose from, each with a distinct narrative lens.

Once videos are generated, users further refine their AI-edited video using chat and context-specific quick actions. Users also select a specific agent persona such as "film student" or "marketing director" to craft their video to their specific needs.

When videos are uploaded, IWAI's agentic AI analyzes the content, including speech transcription, sentiment analysis, and key visual elements. The AI agent selects the most important segments and intelligently combines them into three finished final videos, ensuring the user will be satisfied with at least one combination.

Using our web app, video editing becomes seamless and easy for users regardless of experience. This provides an unparalleled ease of use and a magical experience for creators.

The back end of Insight Weaver AI is built using NodeJS while the front end uses ReactJS. The web application is hosted on Microsoft Azure. IWAI uses Azure AI Foundry for AI agents and video content understanding.



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Union Pacific

Cars in the Clear VR Training

Union Pacific has been building America for more than 160 years. Headquartered in Omaha, Nebraska, they manage 32,000 miles of track across 23 western states. Operating 7,000 locomotives transporting 8.3 million cars of goods a year, they play a key role in the world's supply chain.

Proper management of railcars is a time-consuming, yet safety-critical task performed by Union Pacific conductors. Inexperience leads to hazardous railyard accidents, which can easily lead to injuries. A straightforward solution is needed to train conductors on how to safely position cars in the yard.

Our virtual reality (VR) application, Cars in the Clear VR Training, creates a true-to-life simulation, simplifying the difficulties of normal training. By training in a virtual space, we provide trainees with hands-on experience before using real equipment, which reduces safety risks. Our application targets two critical skills: placing cars in the clear to stop cars from colliding, and lining switches to guide cars to their proper destination.

Cars are in the clear when they do not interfere with passage on an adjacent track. Trainees are shown the clear area of a track, then must properly position train cars clear of adjacent tracks.

Lining switches is the process of examining and flipping switches to ensure the train follows the desired path. Trainees practice identifying the type of switch and how to properly use them. The trainee then uses the switches to navigate a train to a target track.

The combination of these skills provides critical baseline knowledge for daily railyard operations, reducing accidents and improving workplace safety.

Our Cars in the Clear system is developed as a VR application that runs on a Meta Quest. Our application is written in C# and runs on the Unity game engine.



BUILDING AMERICA®



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Urban Science

Generating Mapping Insights Using AI

Headquartered in Detroit, Michigan, Urban Science is a global automotive consultant and technology provider that delivers data-driven solutions for original equipment manufacturers and dealerships. Since its founding in 1977, the company has utilized and leveraged data science, analytics, and software to help automotive brands optimize performance and make smarter market decisions.

As the automotive industry continues to expand and evolve, both dealerships and manufacturers face growing challenges in understanding market performance at a detailed level. Interpreting key metrics, such as sales and market share, can be especially complex when comparing results across different regions.

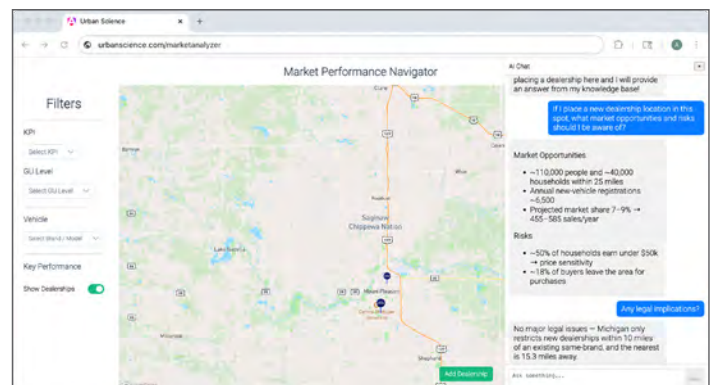
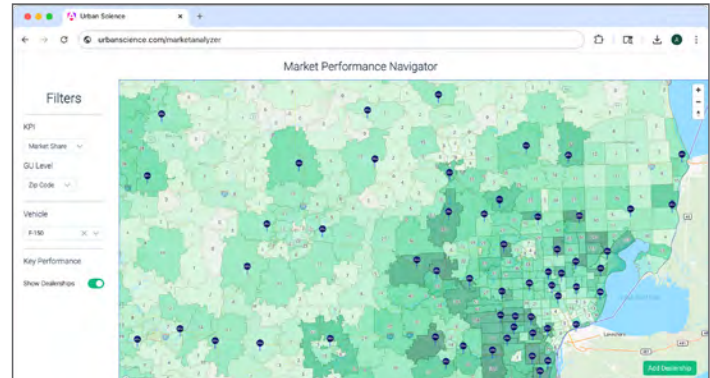
These challenges highlight the need for a tool that simplifies market insights and provides clear information on managing dealership territories.

Our Generating Mapping Insights Using AI software addresses this need by providing interactive heat maps that display changes in key performance metrics and demographics. This application enables users to easily identify optimal locations for opening new dealerships or relocating existing ones.

After relocating or adding a dealership, our system generates an AI response that interprets regional performances, enabling users to understand shifts in key metrics. It also highlights potential legal risks, such as dealer protests and state regulations, saving personnel the effort they would need to spend reading legal documents.

Our software takes the guesswork out of dealership planning, enabling users to spot opportunities, avoid risks, and make smarter decisions in a competitive market.

The application uses Angular for the front end. The back end is implemented in C# with .NET and our suite of technologies is hosted on Microsoft Azure. The data storage and LLM queries are handled through Azure OpenAI and Azure SQL.



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UWM

IT Goals Dashboard

Founded in 1986 and headquartered in Pontiac, Michigan, United Wholesale Mortgage (UWM) provides mortgage products and services to mortgage brokers nationwide. UWM is the top wholesale lender in the past ten consecutive years within the United States, serving millions of customers every year.

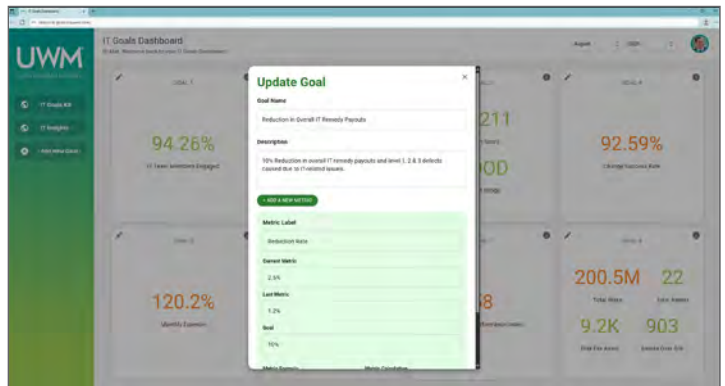
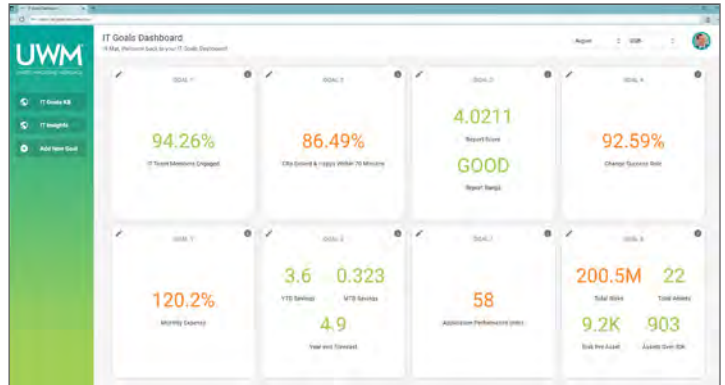
As a leader in the mortgage industry, UWM stands out in its commitment to developing and providing innovative technological solutions for brokers and borrowers. To uphold this commitment, UWM sets yearly and monthly goals for each department. IT department goals help management by tracking helpful metrics relating to employee engagement, reduced expenses, and measures of success and risk within the department.

Our IT Goals Dashboard assists department members in tracking goal progress and enables administrators to input custom data points. Our application provides team members with visual representations of goal data in the form of graphics, colors, and charts, making it easier to analyze trends at a glance and measure key data trends over time.

Our software enables users to view both current and historical data to compare performance across months and years. Admins have the flexibility to add or edit yearly goals along with their metrics. Together, these features empower employees to allocate resources more effectively and improve overall productivity.

By replacing static spreadsheets with our interactive system, the dashboard strengthens accountability, increases transparency, and promotes a more data-driven culture across the IT department.

The IT Goals Dashboard is built with a React front end and utilizes Swagger UI for API interactions. The back-end services are developed with ASP.NET Core in C# which are exposed through REST API. Finally, the data management relies on Entity Framework Core and an Azure SQL Server.



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Vectra AI

Packet Forge: AI Network Protocol Engine

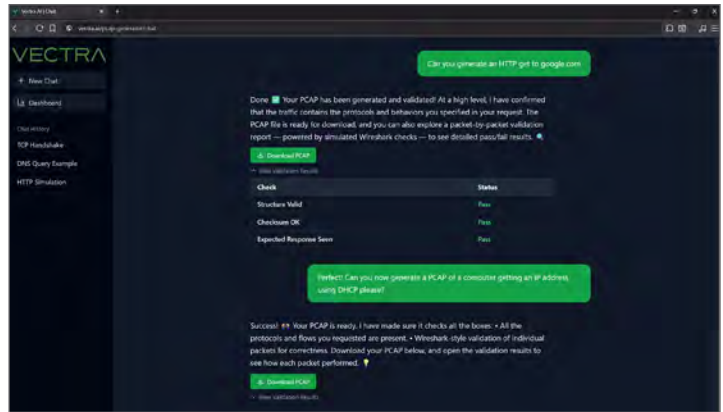
Vectra AI is a leader in the cybersecurity field, harnessing the power of artificial intelligence (AI) to provide clients with state-of-the-art cybersecurity threat detection and real-time response across all domains of enterprise systems. Backed by over a decade of experience, Vectra AI protects enterprises in 113 countries.

Today, the accuracy of threat detection systems depends heavily on access to high-quality, realistic computer network traffic data. Modern enterprises rely on a wide variety of protocols, but producing representative packet captures (PCAPs) for training and testing detection systems is both time-consuming and technically demanding. Engineers rely on manual creation methods, which slows down the ability to respond to new or evolving threats in a timely manner.

To address this challenge, our AI Network Protocol Engine leverages natural language processing and large language models to extract metadata from formal protocol documentation. With this structured data, the system automatically produces realistic internally consistent traffic that is industry compliant. The generated traffic covers a variety of different scenarios over multiple protocols, providing an abundant source of accurate packets for keeping threat detection up to date.

Our system expands the breadth and quality of Vectra AI's training datasets, filling gaps in protocol coverage while reducing engineering overhead. It ensures that Vectra AI's detection models remain effective against threats carried over both common and emerging protocols to strengthen client security across the globe.

The AI Network Protocol Engine UI is a local web app built with React. The back end uses ChromaDB for structured storage and OpenAI 4.1 mini as the large language model responsible for generating realistic PCAPs. All generated traffic is validated in Wireshark to ensure accuracy and internal consistency.



VECTRA[®]



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Whirlpool Corporation

Intelligent Recognition and Inventory System (IRIS)

Whirlpool Corporation, headquartered in Benton Harbor, Michigan is a global home appliance manufacturer with approximately \$17 billion in annual sales, 40 manufacturing and research centers, and 44,000 employees. Whirlpool's mission is to improve satisfaction and engagement with its home appliances.

Buying groceries is a common chore that consists of tedious planning. However, items get lost in the fridge from time to time. This results in food waste and repurchasing of food which hurts the buyer's budget and creates the stress of needing to manually track groceries.

Our Intelligent Recognition and Inventory System mitigates this problem by providing an automated up-to-date inventory with the fridge's contents and a history of recent groceries that have been added or removed from the fridge.

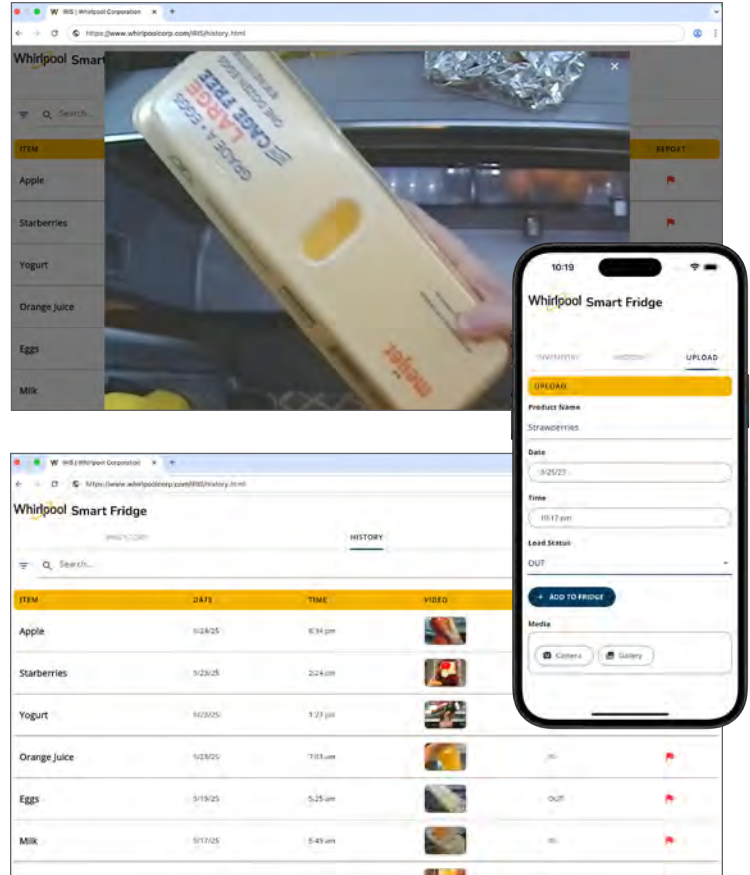
When a user opens the fridge, a camera scans and identifies the product in the user's hand. Our system determines whether the product is being placed in or removed from the fridge and updates the inventory accordingly.

Manual addition of grocery data is also supported. Any errors with the image recognition are tracked via the red flag icon in the table.

As the inventory is updated with current items in the fridge, the user sees a history of objects that were loaded or unloaded from the fridge. In addition, a video playback is accessible to the user to view the most recent groceries that have been either loaded or unloaded.

Our system reduces food waste and provides additional value to Whirlpool appliances.

The software is built with Flutter and Dart for the user interface with a Python and Firebase back end. Our software also utilizes YOLOv8 object detection model.



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Design Day Awards

CSE 498, Collaborative Design, is the senior capstone course for students majoring in computer science. Teams of students design, develop and deliver a significant software system for corporate clients. The CSE capstone teams compete for four prestigious awards. Here are the winners from the spring of 2025.

Auto-Owners Insurance Exposition Award

Auto-Owners INSURANCE

CSE 498 capstone teams present their projects on Design Day in a variety of ways. Teams create and set up an exhibit where they demonstrate their software systems and answer questions from Design Day attendees including the Design Day judges.

The CSE capstone team with the best overall Design Day performance is honored with the Auto-Owners Exposition Award, which is sponsored by Auto-Owners Insurance Company of Lansing, Michigan.

Team Union Pacific

Training Simulator Using GPS-Indexed Video



Nico Roberts, Ravi Gangaiahnadoddi Kumar, Mohamed Ahmed
Abigail Werden, Tre Benson, Melinda Fadool
Presented by Brad Shafer and Ross Hacker of Auto-Owners

MSU Federal Credit Union Praxis Award



One of the hallmarks of CSE 498 capstone projects is that of praxis, the process of putting theoretical knowledge into practice. Teams apply a wide variety of information technologies to produce solutions to complex problems in areas such as business, engineering, computing, and science.

The CSE capstone team that engineers the software system that is the most technically challenging is recognized with the MSU Federal Credit Union Praxis Award, which is sponsored by MSU Federal Credit Union of East Lansing, Michigan.

Team RPM

Automated Damage Logging for Truck Drivers



Troy Williams, Alfredo Sanchez Perez, Dheeraj Thota
Gavin Bourdon, Flower Akaliza, Hayden Rance
Presented by Ben Maxim (Right) of MSU Federal Credit Union

Spring 2025

While each of the awards has a principal focus, every winning team is required to deliver a comprehensive software system, and to demonstrate outstanding communication skills by presenting, demonstrating and defending their work.

TechSmith Screencast Award



Each CSE 498 capstone team produces a video that describes and demonstrates their software product. Starting with a storyboard and a script, teams use Camtasia Studio to synthesize screen recordings, video, audio and other multimedia to produce their project videos.

And the TechSmith Screencast Award goes to... the CSE capstone team with the best project video. The award is sponsored by the creators of Camtasia Studio, TechSmith of East Lansing, Michigan.

Team McKesson
Vulnerability Scan and Detect



Ananya Chittineni, Nicholas Felarca, Brady Johnson
Chris Nguyen, John Bannon, Demetrius Wilson
Presented by Scott Schmerer and Tony Lambert of TechSmith

Amazon Sigma Award



The CSE 498 experience represents the capstone of the educational career of each computer science major. An intense semester of teamwork produces impressive deliverables that include a formal technical specification, software, documentation, user manuals, a video, a team web site, and Design Day participation. The resulting sum, the capstone experience, is much greater than the parts.

The capstone team that delivers the best overall capstone experience is recognized with the Amazon Sigma Award, which is sponsored by Amazon of Seattle, Washington and Detroit, Michigan.

Team NetJets
Airport Capacity and Ground Space Management



Jay Scott, Ryann Seymour, Ryan MacDonald
Ben Grycza, Kendall Korcek, Emily Telgenhoff
Presented by John Marx of Amazon