The Capstone Experience

From Students...to Professionals

COMPUTER SCIENCE AND ENGINEERING 2020-2021

MICHIGAN STATE
UNIVERSITY

Auto-Owners
INSURANCE
LIFE · HOME · CAR · BUSINESS

The Capstone Experience

Department of Computer Science and Engineering

**CSE498,
Collaborative Design**

**Dr. Wayne Dyksen
Professor of Computer Science
and Engineering**

The Capstone Experience provides the educational capstone for all students majoring in computer science at Michigan State University. Teams of students build software projects for corporate clients.

During the Capstone Experience, students

- design, develop, debug, document, and deliver a software project for a corporate client,

- work in a team environment,

- develop written and oral communication skills,

- become proficient with software development tools and environments, and

- consider issues of professionalism and ethics.
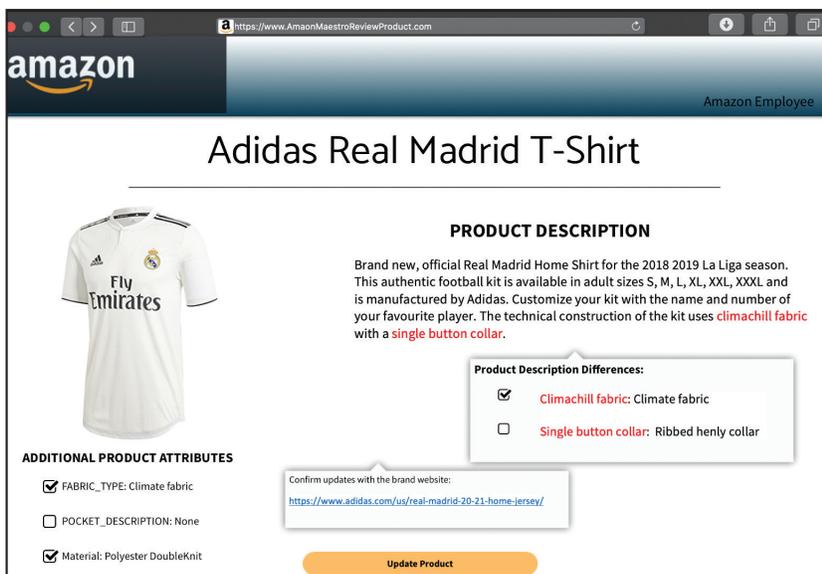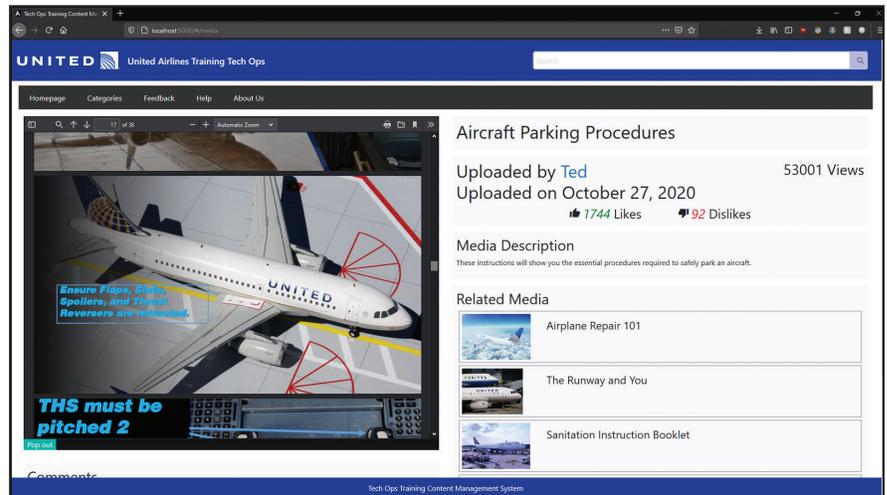
Corporate clients are local, regional, and national including Amazon, Anthropocene Institute, AppDynamics, Auto-Owners Insurance, Bedrock Detroit, Bosch, Dow Chemical, CSAA Insurance, Delta Dental, Evolutio, Ford Motor Company, General Motors, Google, Herman Miller, Humana, Learning A-Z, Lockheed Martin Space, Malleable Minds, Meijer, Microsoft, Mozilla,MSU Federal Credit Union, Proofpoint, Rocket Mortgage, TechSmith, United Airlines, Urban Science, Vectorform, and Volkswagen.

At the end of each semester, the College of Engineering sponsors Design Day, at which student teams from throughout the College showcase their Capstone projects throughout the Engineering Building.

Computer science capstone teams demonstrate the software projects that they have designed, developed and delivered for their corporate client. Teams compete for four awards, which are conferred by a panel of corporate judges.

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We thank Auto-Owners Insurance, a Fortune 500 company headquartered in Lansing, Michigan, for their continued support of Michigan State University and the Capstone Experience, including the printing of The Capstone Experience booklet.

Check out the Capstone Experience web site at www.capstone.cse.msu.edu. For more information about the capstone experience or becoming a capstone project sponsor, contact Dr. Wayne Dyksen by email (dyksen@msu.edu) or by phone (517-353-5573).

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Projects Fall 2020

Amazon
Maestro

Founded in 1994 as an online bookstore, Amazon is the largest online retailer in the world. Amazon has seen tremendous growth and success, making history by becoming the second U.S company to be valued at $1 trillion. A key factor in Amazon's rise to the top is their e-commerce platform, which accounted for nearly 50% of all online retail purchases last year.

At Amazon's scale, individual products often have numerous different sellers. Each seller provides a description and specification list for their product, making it Amazon's job to compile every seller's contribution into a comprehensive overall product description. Issues arise when multiple sellers provide separate, sometimes conflicting, descriptions for the same product, leading to inaccurate product descriptions.

Our Maestro system combats this problem by comparing and correcting the product descriptions from many sources, including the information from the seller, the manufacturer's website, as well as third-party websites such as Target or Walmart. Maestro collects all of this information in the background, and does not require any work from the seller.

Maestro analyzes all of this data using natural language processing (NLP) and determines the best description for all products sold on Amazon. If any difference is detected between a seller's description and Maestro's description, the seller is notified and given the chance to change their description.

Our Maestro application reduces the number of inaccurate product descriptions presented to customers, who get exactly what they expect. This leads to greater sales and customer satisfaction.

Maestro is built with React for the front end, AWS Lambda for the back end, pre-trained SpaCy models for NLP, Amazon S3 buckets to hold files for inaccurate product descriptions, and AWS DynamoDB for holding product data provided by Amazon.
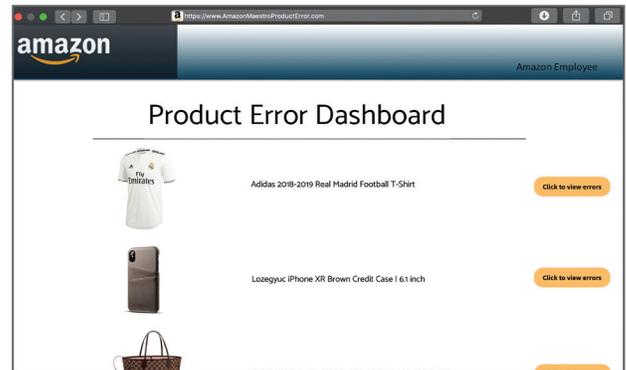
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AppDynamics
Insider Threat Detection

AppDynamics is an application performance management and IT operations analytics company based in San Francisco. The focus of their work and applications is to manage the performance of client's applications across cloud computing environments and data centers.

To further provide aid to clients, AppDynamics looks at the security side of applications, considering how their users may be a threat. Half of all data breaches occur because of "trusted insiders," either via compromised credentials or malicious actions by authenticated users. Currently there are no commercial tools that track user actions to expose potential insider threats.

Our Insider Threat Detection system collects and stores actions performed by users. Using this data, our system works on a case-by-case basis to find each end user's tendencies.

When an end user's actions stray from their tendencies, it is evidence that their behavior could be a security threat. These potential threats are shown on a dashboard. Threats are shown in order of the time of occurrence, rated from high risk threat to minor disruption in pattern.

From the dashboard, a system administrator can take action against any detected potential threat.

Our system automatically takes action against users who are determined to be a definite threat. A system administrator is contacted if the threat is determined to be high risk. They are informed of both the threat and the action taken.

Our software detects and flags suspicious behavior and brings it to the attention of administrators for quick and easy handling, allowing security leaks from insiders to be caught early.

Our threat detection algorithm is created using Python and utilizes AppDynamics APIs to acquire the data. The dashboard is built using HTML and Flask.
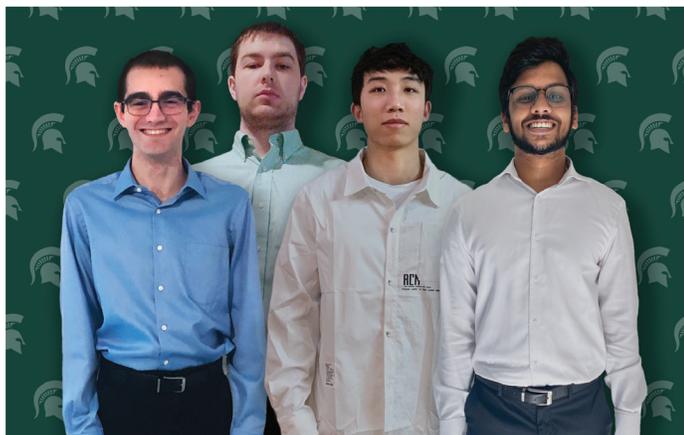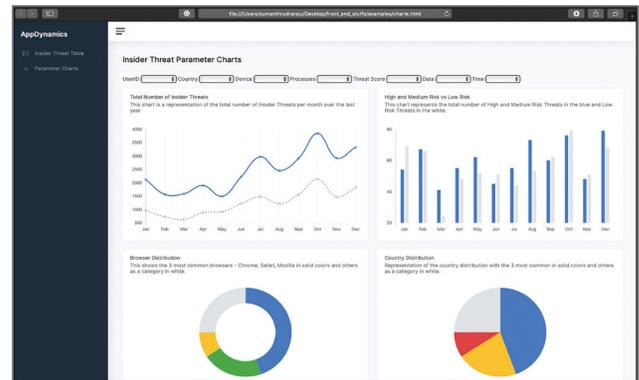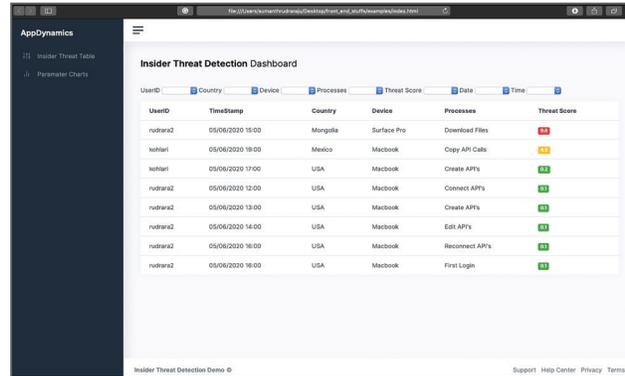
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Atomic Object
PlanIt Capacity Tracking Tool

Atomic Object is a custom software design and development consultancy based out of the Midwest cities of Ann Arbor, Grand Rapids and Chicago. Since its founding in 2001, Atomic Object has been creating unique software solutions for a variety of companies spanning multiple different industries, including Ford, John Deere and Herman Miller.

A capacity tracking application called PlanIt is currently used by Atomic Object to organize and schedule different employees and teams to help allocate their time and resources efficiently. While the current PlanIt application has worked well for years, it is starting to show its age. Its user experience is lacking in a few key areas and was built with old technologies that do not support modern features.

Our PlanIt Capacity Tracking Tool is a ground up rebuild of Atomic Object's current PlanIt tool, with improved user experience and the power of modern development frameworks. Our PlanIt tool offers new and intuitive ways for managing capacity while maintaining the core functionality of the original PlanIt application.

PlanIt's central feature is its timeline view, which allows users to easily see which projects are active, funded, who is assigned to them, and their projected end dates. Users can easily add and remove projects and assign roles and dates all through our new modal boxes and navigation tools. Existing projects and assignments can also be manipulated through a new drag-and-drop feature, which allows for faster and easier planning.

PlanIt helps Atomic Object quickly and efficiently schedule their employees and projects, leading to higher customer satisfaction and less wasted time.

The Planit Capacity Tracking Tool is a single-page application and uses front-end frameworks ReactJS, Redux, and Bootstrap, and back-end services Node.js, Heroku, PostgreSQL, and GraphQL.
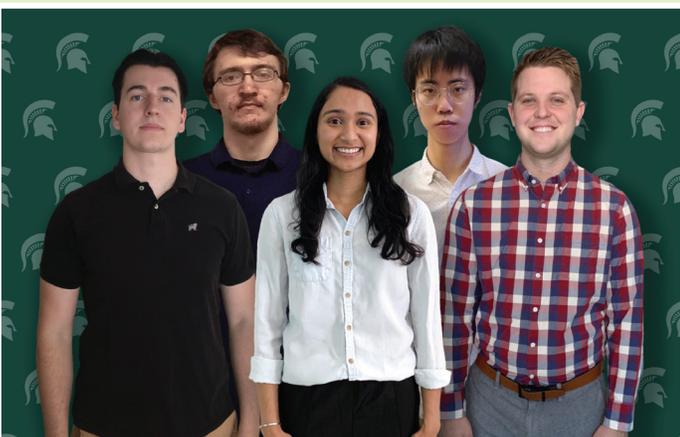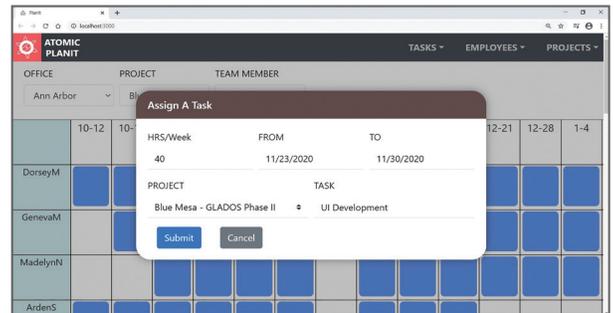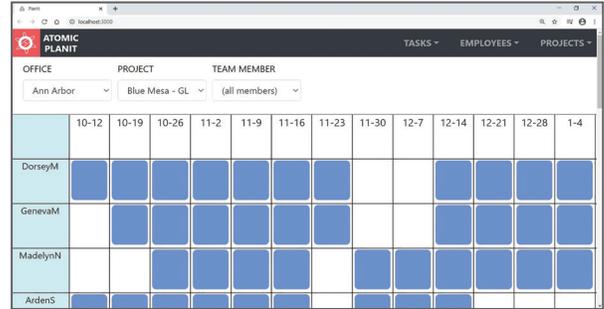
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Auto-Owners Insurance
Coverage Crisis: Covering Your Assets

Headquartered in Lansing, Michigan, Auto-Owners Insurance is a Fortune 500 company that is represented by over 47,000 licensed insurance agents across 26 states. Auto-Owners provides automotive, home, life and business insurance to nearly 3 million policyholders.

Insurance is a complicated topic, with many terms and concepts that can be a struggle to learn. Auto-Owners is innovating new methods to teach associates and third parties about insurance to enable them to learn insurance concepts in an engaging manner.

Our software, Coverage Crisis: Covering Your Assets, is a role-playing game that presents the player with opportunities to learn about insurance. The goal of the game is to earn as many coins as possible as well as maintain the happiness of the player character.

Players select their level of education and career, determining their salary and student loans. They can use coins to purchase assets such as vehicles and homes, which can increase happiness. When purchasing assets, insurance policies are offered to protect against damage that may occur randomly throughout the game. A large component of gameplay is choosing whether or not to buy insurance, thereby selecting which risks to take with one's property.

When the game ends, the player's score is calculated based on their current coins, the value of their assets and any achievements they have earned. This score is posted to a leaderboard, allowing the player to compare their scores and decisions to those of high scoring players. Administrator users can access a secured website to see more detailed information about the decisions a player made during the game.

Our game is made in Unity, written in C#, and is playable through WebGL. Leaderboard and logging data are communicated to and from a MySQL database using PHP server-side scripts. The administrator tool also uses PHP and runs on the same server.

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Bedrock Detroit
Shared Parking Access

Bedrock Detroit is the largest full service commercial real estate firm in Downtown Detroit. With a portfolio of more than 100 properties totaling over 18 million square feet, Bedrock Detroit specializes in the strategic redevelopment of urban cores.

The COVID-19 pandemic revealed that employees working for the Rock Family of Companies benefit from working in a hybrid model, using a combination of working from home and in the office, as it increases productivity and community morale.

We have developed a new space planning strategy that focuses on the rotating nature of team members' in-office schedules.

Our Shared Parking Access system optimizes shared parking assignments by maximizing the number of team members assigned to walkable parking without exceeding the number of spaces allocated to each parking facility.

Bedrock administrators can use the web application to manage team members, parking facilities, and office buildings. They can upload employee schedules and run an algorithm that determines parking assignments. Then, employees are informed via SMS or email about their new parking assignment.

Employees can use the mobile application to view information regarding their parking assignment, including facility name, driving directions to the facility, and walking directions to their office.

The Shared Parking Access application allows quick and efficient scheduling of employee on-campus parking, leading to less wasted time and better optimized assignments.

The front end of the Shared Parking Access website is built using PHP, HMTL5, JavaScript and CSS while the mobile application is built using Java and Kotlin. The API and algorithm are both implemented using Python. SQLite is used to host the database and Microsoft Azure is used to host both the front end and back end of the application.
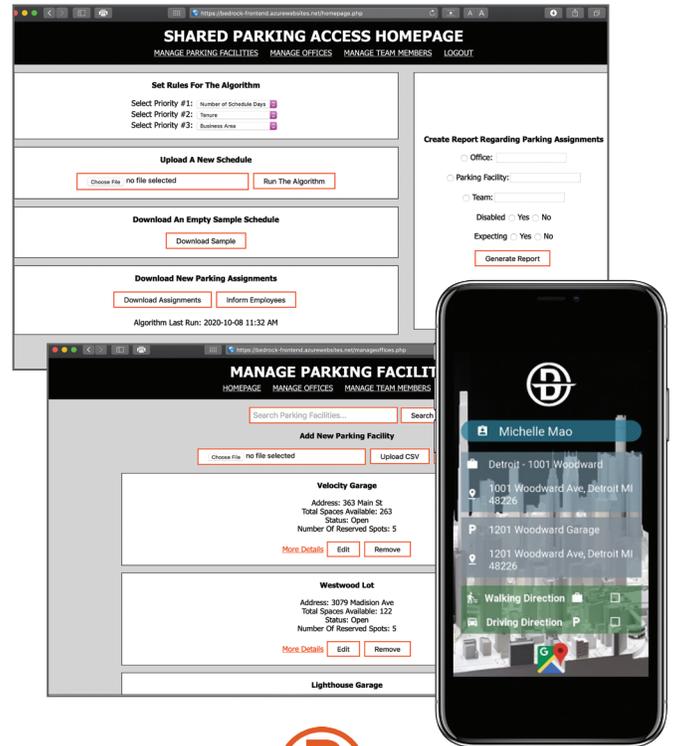
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Bosch
Automated Retrieval of ADAS Driving Environments

Bosch is a global engineering and technology company with products sold in 150 countries worldwide. Founded in Germany in 1886, Bosch is the world's leading supplier of automotive components.

In the testing and development of advanced driver assistance systems, Bosch collects thousands of hours of video footage and radar data from their vehicles. This data is later used to simulate tests on newly developed software without the need to send a vehicle out into the field.

Certain vehicle software is affected differently by specific environments, so for any new software, it is important for Bosch to conduct a range of tests on these various environments. However, Bosch employees must first manually search through their immense volume of data to locate the proper footage, which can be time-consuming and difficult.

Our Automated Retrieval of ADAS Driving Environments alleviates this issue by automating the task of processing and searching through the video data.

Using computer vision and machine learning, footage is tagged and categorized based on features in the environment (such as rain, night, bridge, highway, etc). Once the videos have been processed, the tags and associated videos are saved for later searching.

Bosch employees can then search for videos containing specific conditions simply by selecting the desired tags and clicking 'search.'

Our software saves Bosch employees time by automatically tagging video environments and provides easy searching through large quantities of video.

Our front-end web application is built with React.js and Material-UI. The back end is built with Flask and utilizes the OpenCV library and YOLOv3 algorithm. The SQLite database holding the processed video and tags is built with SQLAlchemy.
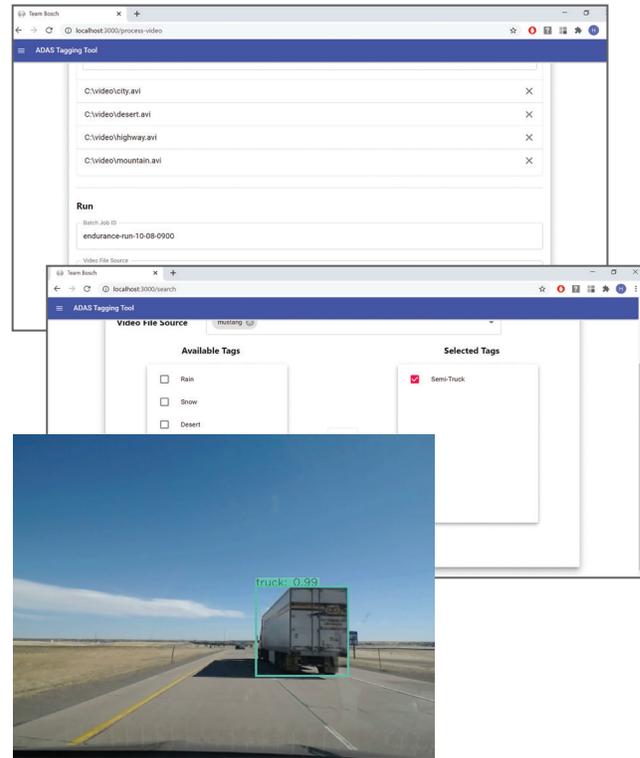
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The Dow Chemical Company
Artificial Intelligence Project Matcher

With over 100 years of success and industry-leading innovation, Michigan-based Dow is a global leader in specialty chemicals, plastics, and advanced materials. From paper to plastic, Dow provides a state-of-the-art collection of cutting-edge, sustainable, and dependable products.

Recently, Dow began investing resources towards alternative means to drive efficiency and growth within the company. Among these means is artificial intelligence (AI). Artificial intelligence is among the fastest growing fields at Dow, and ensuring the right skillsets are assigned to the right projects has become difficult due to the distributed nature of AI expertise.

Our AI Project Matcher eliminates these difficulties by matching skilled employees with innovative AI projects, as well as matching AI projects with qualified employees. This is accomplished with our advanced recommendation algorithm.

Using our mobile application, an employee is able to search through projects that may interest them. Similarly, a project sponsor can search through available employees that are qualified to work on their project.

Once an employee and a project sponsor both select that they are interested in each other, they are matched. After matching, the talent and sponsor contact information is shared, expediting the project recruitment process.

Through the use of our simple yet powerful application, Dow employees can now quickly discover projects to join and project sponsors can rapidly acquire the talent needed to complete their project.

Our mobile application is built using Visual Studio Code. The front end is implemented in React Native and the back end utilizes Node.js. All user information is stored and accessed through a MySQL database.
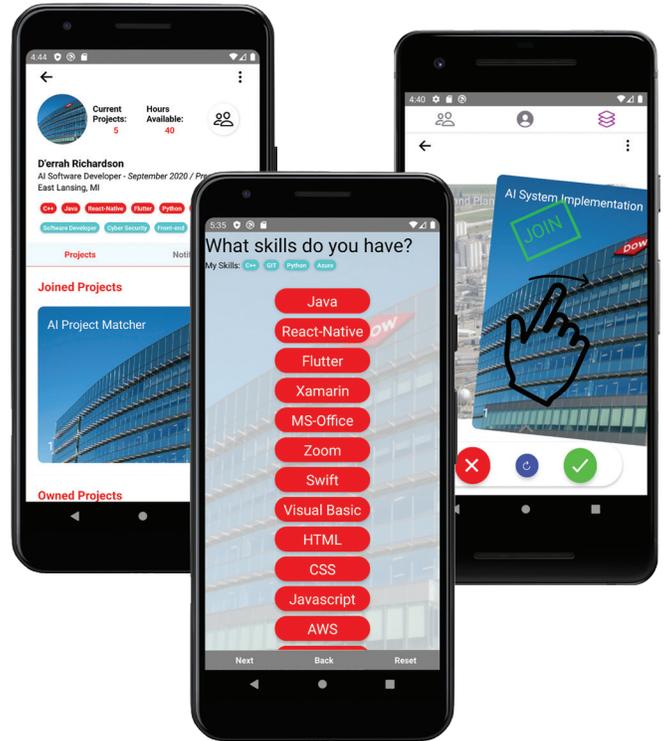
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Evolutio
#BIKES4ERP Tracking Initiative

E volutio is a group of technology professionals convinced that business problems have significantly simpler solutions than the market is led to believe. Evolutio works with the non-profit Elephants, Rhinos and People (ERP), on its #BIKES4ERP initiative. #BIKES4ERP provides bikes to rural students in South Africa.

The bikes provided by ERP help students get to school faster and with more energy to learn. The students that receive bikes from ERP have commutes of up to 10 miles to get to and from school. A bike makes this four times faster and less strenuous for the students.

There are currently hundreds of bikes in use by #BIKES4ERP, and a single mechanic currently handles all bike repairs. As the #BIKES4ERP project continues to expand, the current pen-and-paper method of tracking their bikes becomes less and less viable.

Our #BIKES4ERP Tracking Initiative includes a suite of mobile and web apps that assist teachers, mechanics, and ERP administrators in facilitating and maintaining their fleet of bikes.

The ERP teachers' Android app is used to log daily bike check-ins and submit maintenance requests for any broken bikes.

The ERP mechanics' Android app is used to keep track of maintenance requests from teachers, organize the mechanics' digital inventory, and order any needed bike parts.

The ERP administrators' web app is an interface for ERP administrators to look at various analytics. The web app uses data from the teachers, mechanics, and schools to show bike performance and data relating to student academic performance to help understand the link between having a bike and succeeding in school.

Our ERP teacher and mechanic client applications are built using Java. The ERP administrator web app uses the ReactJS framework. The apps use Firebase services to store information and handle reliable data sync in poor network connectivity areas.
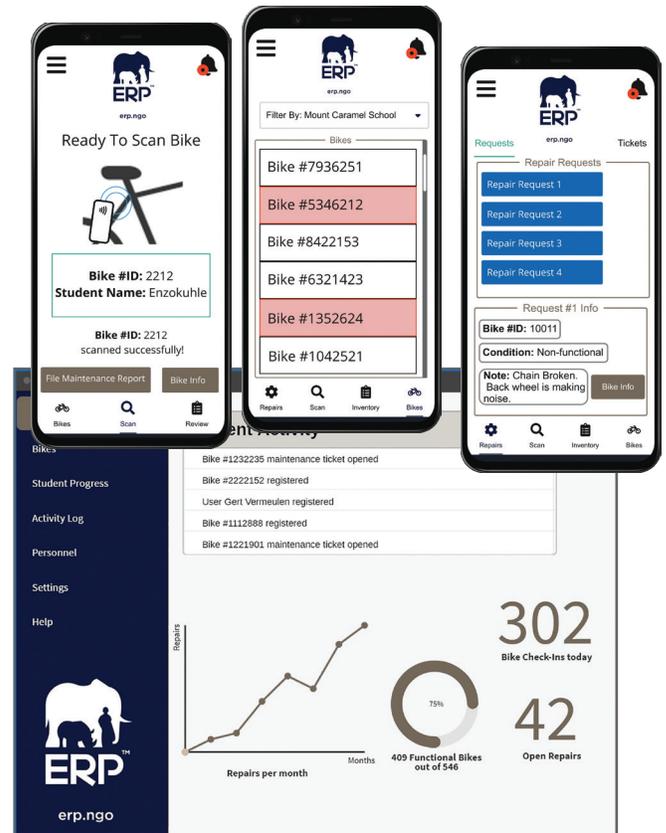
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Ford Motor Company
Ford Accelerate Monitor

Ford Motor Company is a multinational automotive manufacturer headquartered in Dearborn, Michigan, employing 199,000 employees and producing a total of 5.9 million vehicles in the last recorded year. Ford designs and manufactures a full line of cars, trucks, SUVs and electric vehicles under both the Ford and Lincoln brands.

Ford is committed to delivering software in the mode of continuous integration/continuous deployment (CI/CD) – that is, frequently adding to a project in small ways. To achieve this, teams must be highly coordinated and communicate their progress continually. However, the COVID-19 pandemic has resulted in development teams being distributed across residences, making it challenging for teams to keep track of their progress.

Our Ford Accelerate Monitor provides team members with an easy way to monitor projects. This includes lead time, deployment frequency, mean time to restore, and change fail percentage.

Users can register projects consisting of various CI/CD products including Jenkins and GitHub. They can also track incidents through our web portal.

Once registered, members can connect to the application through a Google Assistant device to ask for statistics about any specific team or project, for example, "What is the change fail percentage for Team Viking over the last 28 days?" Additional statistics like build frequency and build failure notifications are also available.

Our system makes it easy for teams to track their progress remotely, leading to increased productivity.

Our back end is a SpringBoot application written in Java, while our front-end portal is built using VueJS. Our data is stored in a Firebase database, and a REST API framework is used to connect everything together.

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General Motors
Automotive Specific Dark Web Threat Intelligence

General Motors is one of the world's top automotive manufacturers, having sold over 10 million vehicles worldwide. GM is headquartered in Detroit, Michigan and is known for brands like GMC, Buick, Chevrolet and Cadillac.

The dark web is a place where people are able to share confidential information with low risk of being recognized. GM is committed to the security of their data, products and employees, and is aware that unauthorized parties may find methods of acquiring private GM assets.

Our Automotive Specific Dark Web Threat Intelligence system provides a method of identifying and analyzing unusual activity by crawling through suspicious websites on the dark web and scraping the information for further investigation.

The Dark Web Threat Intelligence app is scheduled on a server to run at specific intervals. As it runs, it references a specified list of websites to scan for confidential GM information. When information is found, it takes a screenshot of that page and scrapes the text for analysis by the GM security team.

The information from dark web sites is stored in our database where it is referenced for ranking. The application compares scraped information to a set of terms and assigns the url a threat level based on its contents. GM IP addresses and employee credentials are given high threat levels, whereas mentioning the GM name or brands yields a low threat level.

The GM security team uses this information to identify information leaks and threats to company security.

Our Dark Web Threat Intelligence app uses AWS to host our web app, the database, and run the scraping algorithm. The scraper is run using Python scripts and the scraped information is stored in a MySQL database. Our web app uses React to display the database information and update the data when needed.
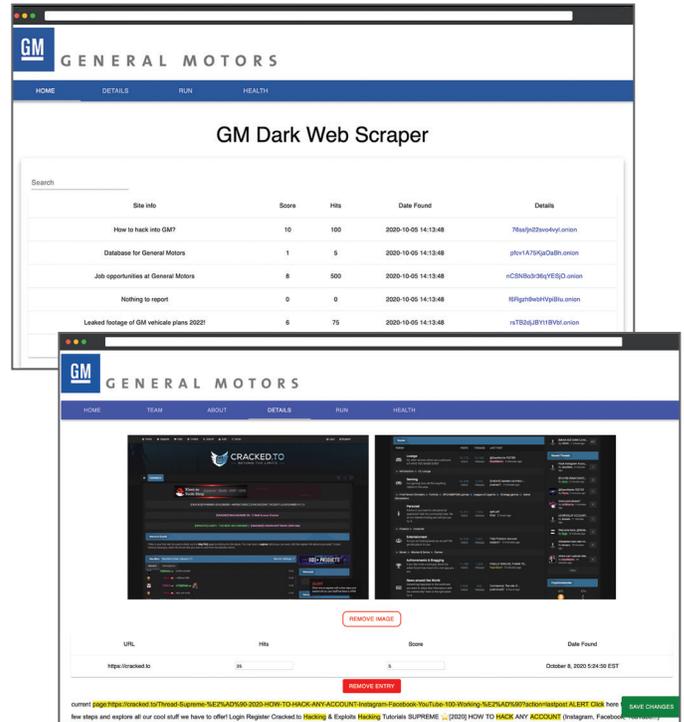
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Google
Self-Service Support Chatbot for Google Cloud

Google's mission is to organize the world's information and make it universally accessible and useful. To make powerful computing tools accessible to all, Google offers the Google Cloud Platform (GCP) suite of cloud computing products. This platform includes products that assist in data management, artificial intelligence, and application security.

When a GCP customer encounters an issue and contacts support, manually collecting error logs and project details is time-consuming. Additionally, many problems can be quickly fixed by pointing the customer to public documentation about the product. These types of problems take significant time and slow down customer support for other users.

Our Self-Service Support Chatbot for Google Cloud is a suite of tools, including a customer support chatbot that automatically gathers information about errors in order to identify and provide relevant documentation available on the web.

Our chatbot parses and analyzes a user's question using natural language processing (NLP) and provides relevant information that might help with their problem. However, if the chatbot cannot solve the problem, the chatbot organizes the information it has collected and refers them to human support.

The user contacting human support then submits the information the chatbot has collected. This significantly cuts down on the support engineer's time spent on error information collection and the overall time to issue resolution.

Our chatbot uses machine learning to improve document recommendations over time and tailors its resolution recommendations based on feedback from users.

Our chatbot is built using GCP's Dialogflow and Google's NLP API. React serves the front end for the chatbot and Flask hosts the back end on Google App Engine.
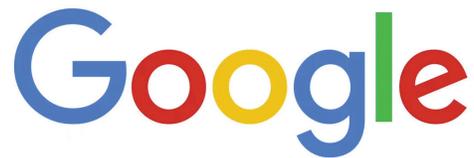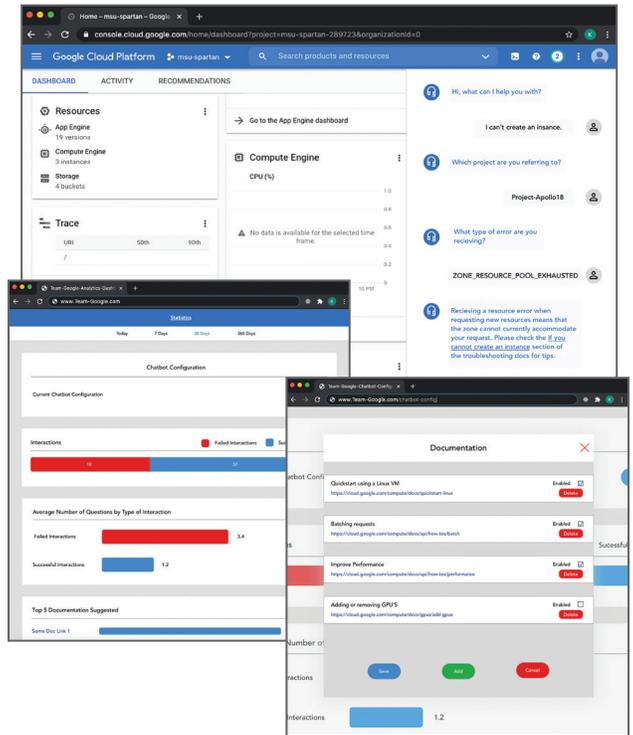
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Herman Miller
Live Platform Real-Time Occupancy Status

Based in Zeeland, Michigan, Herman Miller has produced office and home furnishings for over 100 years. Known for its history of design innovation, Herman Miller dedicates research to office space quality to quantify the effectiveness of different workspace layouts.

One technology service developed by Herman Miller is the Live Platform. Currently, Live Platform gathers data from desk sensors in open offices to provide space utilization analytics. One feature that the desk sensors provide is the availability of a desk.

Open offices are spaces where there are little to no assigned desks. Instead, staff manually seek out a new workstation each day. One issue regarding open offices is determining seat availability. The process of searching for unoccupied desks becomes time-consuming as employees look through various spaces.

Our Live Platform Real-Time Occupancy Status dynamically displays occupancy status on a given floorplan allowing users to pinpoint available desks. The website dashboard offers users access to near real-time open seating availability and provides a streamlined process for determining workspace availability. Our dashboard also displays points of interest throughout a map for users to seamlessly locate a desired workspace.

Our system makes it simple and intuitive for employees to quickly find an open desk in near real time and minimize time spent searching.

Our software solution employs Amazon Web Services to collect and query IoT data from DynamoDB and MySQL RDS using Lambda functions. This data is then exposed through REST API Gateway. Using customer-provided floorplans, a map is generated from MapBox GL JS and availability markers are shown using GeoJSON coordinates.
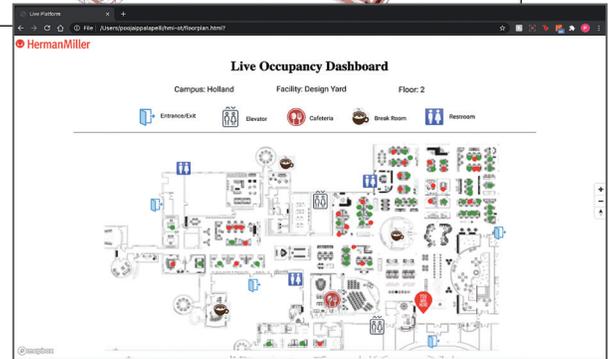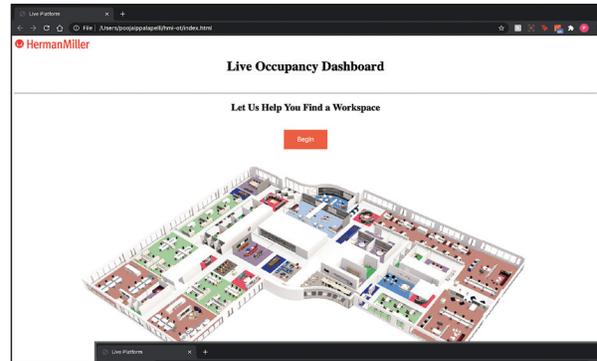
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Humana
Internship Success App

Humana is a health insurance company with nearly 46,000 employees and 13 million members in the United States. The company provides a variety of health cares including Medicare, dental, vision, Medicaid, and pharmaceutical.

While growing within the insurance industry, Humana strives to create employment opportunities for young leaders. Humana hires roughly 50 interns each summer with a 12-week duration. Throughout the internship, interns are expected to set and accomplish goals while completing their summer assignment.

Humana utilizes several platforms for interns to access information during the internship such as calendar invitations, resources, and general inquiry. However, there is not one central location for the interns to guide them throughout the internship.

Our Internship Success App streamlines the internship experience by supplying interns with the necessary tools to succeed in one location. The interns are able to organize internship information, set personal goals, and communicate with other interns and staff.

Upon logging into the application using their Humana credentials, interns can log and track their personal or professional goals. They can create an unlimited amount of goals and track them at their own pace.

The calendar allows users to view Humana event information. Interns can ask the Humana administrative team private questions about their internship and project feedback. To avoid repeated questions, the team may respond to questions and select which ones to make public.

Our application is available on mobile devices running on iOS or Android. Additionally, the front end is designed on Adobe XD and the back end is hosted through React Native. The data is stored using Firebase.
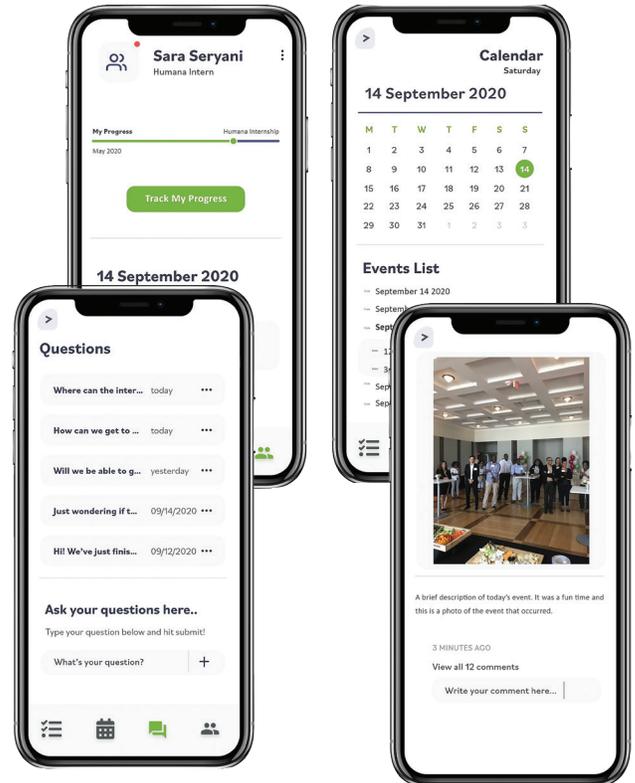
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Learning A-Z
Vocab Slinger Word Definition Game

Learning A-Z, one of the leading companies in virtual learning, provides administrators and teachers with learning materials for pre-kindergarten to sixth grade students. Their digital curriculum is used in classrooms worldwide. They provide students with the resources and skills they need in the classroom and beyond.

In light of the current COVID-19 pandemic, Learning A-Z is meeting the demands for remote learning with their online resources. Students are learning even while away from school.

Our Vocab Slinger Word Definition Game is a web application game that teaches grade school students new vocabulary words and their definitions.

After a difficulty level is selected, the students are presented with three "enemies" who are trying to reach the top of the page. These enemies each have a definition attached to them. These definitions must be matched to the corresponding words from the word bank featured on the page. The complexity of these words and the inclusion of a timer depends on the selected difficulty.

Failing to match the proper word or allowing a set timer to reach zero causes the enemies to rise towards the top. Successful matching "defeats" the enemy, and it is replaced by a new enemy with a new definition at the bottom of the page. The used word is also replaced in the word bank.

The game ends when an enemy reaches the top of the page. The student is then awarded in-application currency corresponding to their performance.

Our software teaches new vocabulary to children in a fun and engaging way that is customized to that child's ability.

The front end of our web application is made using AngularJS and HTML/CSS, the back end is written in PHP with Composer to manage dependencies. The PHP code sends requests to a MySQL database to get word-definition pairs.
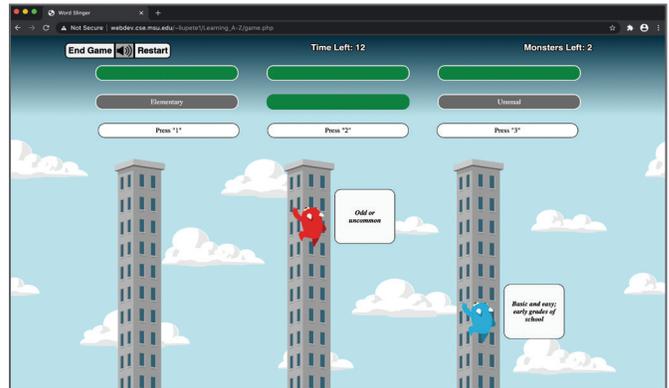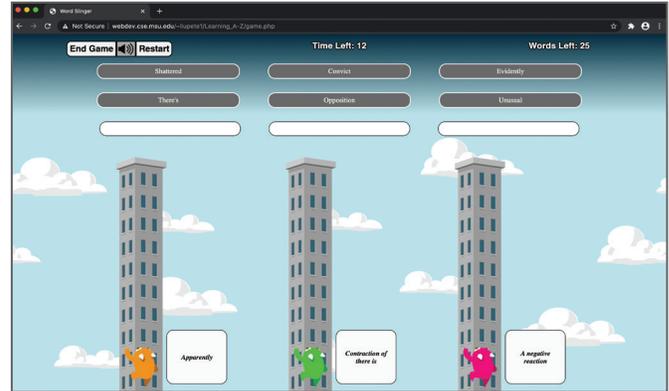
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Lockheed Martin Space
SmartSat™ Heterogeneous Computing in Space

Lockheed Martin Space is one of four subdivisions of Lockheed Martin, an American defense contractor that receives over $40 billion in defense revenue, the most of any defense contractor. Lockheed Martin Space builds and deploys satellites that have various military and commercial applications. SmartSat™ is a suite of tools designed by Lockheed Martin Space to support and deploy software to their satellites.

Lockheed Martin Space's satellites are constantly gathering data, such as images of Earth's surface, which then need to be analyzed. Currently, most of this processing occurs on ground stations, which requires massive amounts of data being sent from satellites to earth over very slow network connections. This transfer of data can take hours or even days before it can be fully processed.

Our SmartSat™ Heterogeneous Computing in Space system combats this issue by allowing data to be processed directly on satellites, instead of requiring data to be sent all the way to earth.

Compared to a ground station, a satellite has less computation capacity, and therefore has to utilize its limited hardware in parallel, running multiple applications at the same time on different hardware components.

An integral part of our system is the Accelerator Manager, which decides what hardware should be used to complete certain tasks. Depending on the current status of the satellite, different hardware should be used in different scenarios. Our system assigns tasks to hardware in a way to minimize processing delay.

Our system reduces the time it takes to analyze data from satellites and ensures the hardware is used to its full capacity.

The back-end applications are built using Lockheed Martin's SmartSat™ SDK. The application uses SYCL and Vitis to run accelerators on available hardware. The software utilizes CPUs, GPUs, Xilinx FPGAs and NVIDIA TX2 boards.
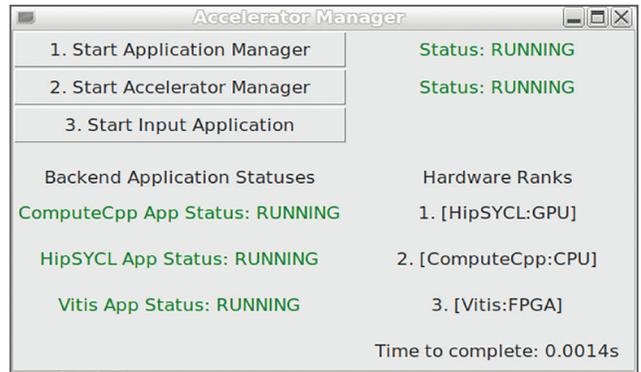
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Malleable Minds
Review Aggregator for Educational Programs

Malleable Minds is an early-stage startup company dedicated to allowing families to easily manage and share educational resources in order to connect them to global educational opportunities.

The company's mission is to connect parents to the best possible educational programs in and around their local area and to receive continuous feedback from reputable sources.

With their many other duties, parents may not have the time or resources to research programs specific to their children's needs.

Our Review Aggregator for Educational Programs provides a solution to this by aggregating certified educator reviews in addition to reviews from other parents to make a one-stop shop for K-12 educational program browsing.

Parents can "like" programs, which will then be saved to their favorites page. They can also opt to receive notifications about a specific program. Educators and parents alike can rate programs, and then the ratings are displayed to all users browsing programs. Parents can also follow educators to see their ratings on other programs.

Understanding the experiences of previously enrolled children and the ability to compare educator ratings serves a critical function for parents in their search to provide enriching, educational experiences for their children.

Our solution supports a growing community of educators and educational providers, allowing parents to make informed decisions based on relevant and current information.

Using a lightweight, contemporary technology stack, we built a responsive user interface so that users can access the application from any personal computer or mobile device. Our software is written in a combination of Python and React, and our system is deployed using Amazon Web Services.
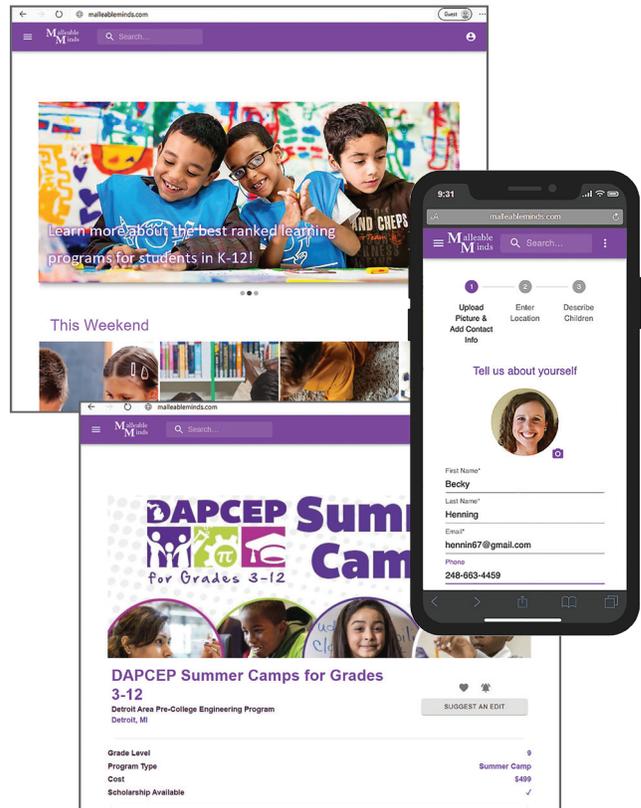
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Meijer
Support Desk Chatbot

Meijer, one of the country's largest supercenter chains, provides high quality groceries and merchandise to several states across the Midwest. Meijer has over 240 stores, 77,000 team members and is continuously improving today's shopping experience with cutting-edge technology like curbside pickup and online grocery ordering.

Over the past decade, Meijer has focused on solidifying their e-commerce presence and moving towards a more data-driven process in making business decisions. The IT Support team is located at the Grand Rapids headquarters where they manage all technical issues faced by the internal associates working within the company. The team regularly receives over 500 phone calls a day, often about issues that have already been resolved.

Our Support Desk Chatbot is a tool that can solve common, repeatedly occurring issues without the need for human interaction. Our chatbot is available 24/7 on Microsoft Teams to assist Meijer team members. When a team member asks our chatbot a question, we use natural language processing (NLP) to parse and analyze the question, and then search through a repository of questions to give suggestions on how to resolve the issue.

If our chatbot is unable to resolve an issue, it automatically generates a support ticket, including all relevant information collected by the chatbot. This allows the support team to quickly solve problems without duplicating effort. Our system allows IT support team members to focus on solving higher priority issues without being bogged down with common issues.

Our chatbot is developed using the .NET Core Framework and is hosted in Microsoft Azure. QnA Maker hosts the knowledge base and provides built-in NLP. The knowledge base is regularly updated, which further assists the helpdesk associates save more time to resolve other escalated problems.
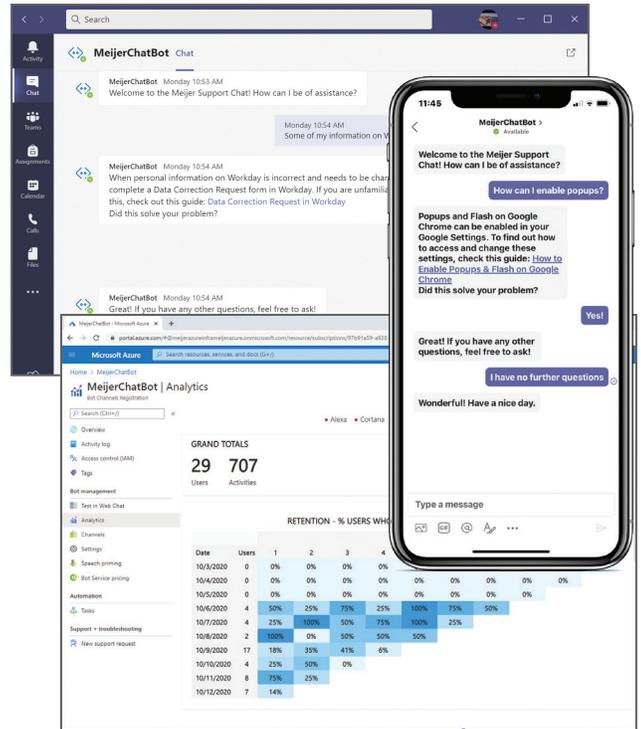
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Michigan State University ITS
Explore: Discover Sports on Campus

M ichigan State University is a public research university with around 50,000 students. MSU Information Technology Services is responsible for developing and maintaining technological resources for all students, faculty, and staff across MSU's campus.

There are many sporting events on campus each year. Each sport has a varying frequency of home games on its schedule. As a result, students do not have an easy, unified way to find out about and keep track of all of these events.

Our Explore: Discover Sports on Campus application provides an easy way for students on campus to find sporting events and related information. Our solution provides three different options for students: a web application, as well as iOS and Android mobile applications. The feature set is the same for all platforms.
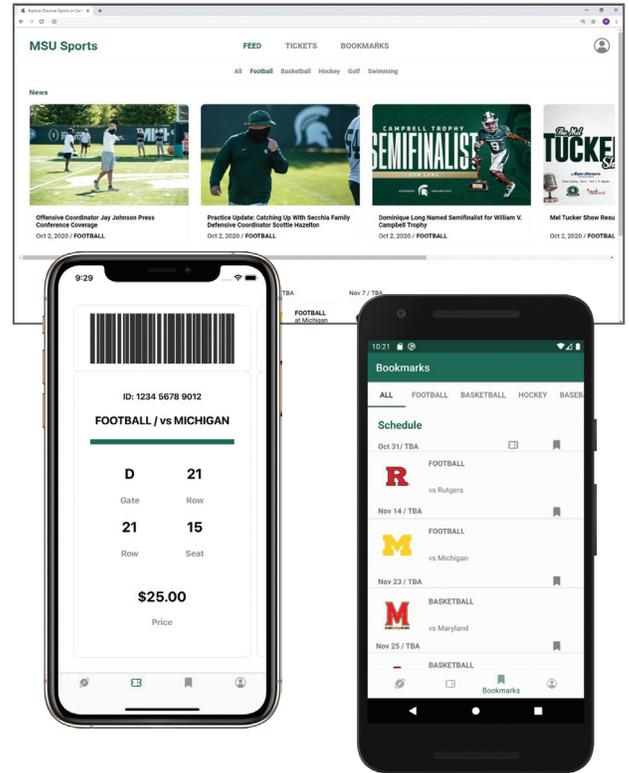
After logging in, users are presented with a feed displaying current sports news and a schedule of games for the upcoming season. Users can click on an upcoming game to view its date, time, location, ticket prices, available seating, and parking information.

The tab bar along the bottom of the page allows users to navigate between the feed, tickets, bookmarks, and profile. They can view their purchased tickets and seating information. A schedule of events that they have bookmarked or have purchased tickets to attend is also available.

Upon visiting the profile tab, users can quickly update their profile or view event history, payments, and a help page.

Our application makes it simple and intuitive to keep track of all sporting events on campus, discover new events to attend, and plan to attend future events.

Explore: Discover Sports on Campus is developed with Vue.js for web, Kotlin for Android, and Swift for iOS. It accesses information stored in a DynamoDB database using an AWS API Gateway via Lambda functions written in Node.js.

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Microsoft
Feedback Analysis Hub for Microsoft Intune

Microsoft is an American multinational technology company that manufactures, licenses, supports, and sells computer products and services. Since its founding in 1975, Microsoft has been listed as one of the 'Big Five' technology companies. They boast the second highest valuation of any company in the world at over $1 trillion.

Microsoft Intune is a cloud-based endpoint management system that allows Microsoft clients to securely manage their devices and private information. This tool simplifies the modern workplace, allowing employees to use their personal devices to access private corporate resources in a secure manner.

As Intune grows and is being adopted by more and more people, it has become harder to gather and analyze user feedback about the successes and failures of Intune. Additionally, many users have taken to posting on public forums about their experience with Intune, which provides a valuable source of feedback for Microsoft.

Our Feedback Analysis Hub for Microsoft Intune collects data related to Intune from public forums, such as Twitter and Reddit, in one central hub to be analyzed. This collected data provides Microsoft engineers with feedback on features and bugs that can improve the Intune experience for customers.

Using our hub, Microsoft employees can filter feedback by sentiment, keywords, and date. They can also analyze data through graphs and charts based on the data. This new source of feedback helps Microsoft quickly stay in touch with the needs of their customers.

The Feedback Analysis Hub is deployed through Microsoft Azure. Our data is stored through an Azure SQL server and is pulled to the website through PHP. The data is shown on the user interface using HTML and CSS. Graphs and visualizations are created through Power BI.
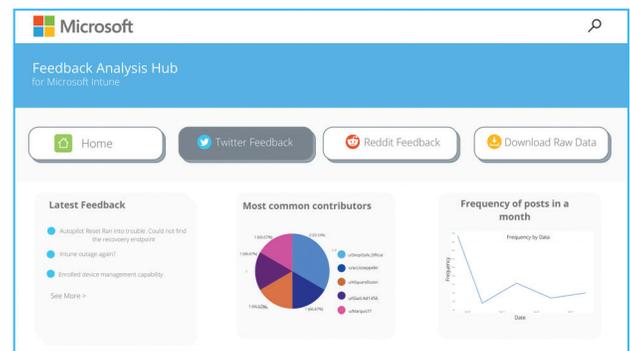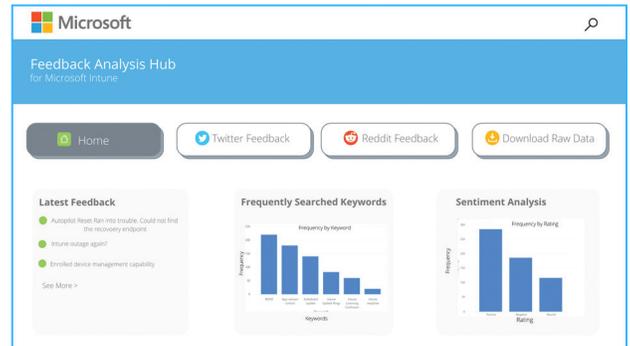
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Mozilla Corporation
Making Firefox's Picture-in-Picture Even More Awesome

Mozilla is the company behind Firefox, one of the world's largest web browsers with well over 200 million users. They are a non-profit, mission-driven organization that emphasizes open-source development to keep the web open and accessible to all, meaning anyone can submit contributions to Firefox by participating in their online community for developers.

Multi-tasking has always been difficult, but has gotten easier with Firefox's Picture-in-Picture (PiP) feature. PiP allows videos to be "popped" out of the browser into a dedicated window that is always on top of all other windows. This is perfect for keeping an eye on sports, or even taking notes while watching a lecture.

Since the release of Picture-in-Picture, many users have requested that the feature be expanded, improved, and made "even more awesome."

Previously, users could not have multiple PiP windows open at the same time. This is particularly useful for events that benefit from multiple perspectives like Formula 1 races, where multiple cockpit camera views can be viewed simultaneously.

Our Making Firefox's Picture-in-Picture Even More Awesome project addresses this issue, while additionally improving the overall user experience of Firefox's PiP.

In addition to multiple PiP support, our project introduces smart snapping to corners: simply flicking the window towards a corner of the screen will snap it there. Additionally, PiP windows now have a "memory" and open with the position and size last set by the user. Our additions to Firefox's PiP feature improve the user experience and functionality of one of Firefox's best features.

Picture-in-Picture is a feature that lives entirely within the Firefox codebase; a vast piece of software spanning multiple languages like C++, HTML, and JavaScript. The feature itself uses almost exclusively HTML and JavaScript.
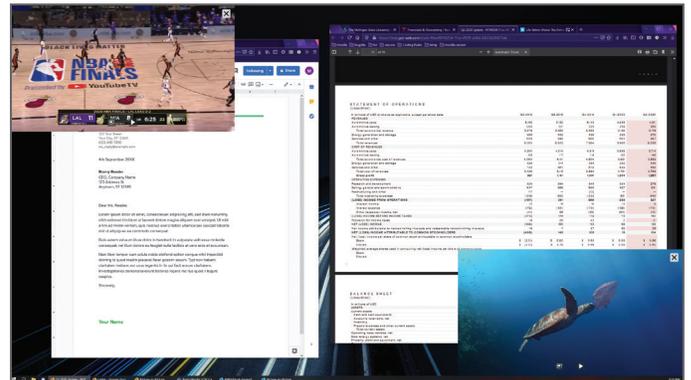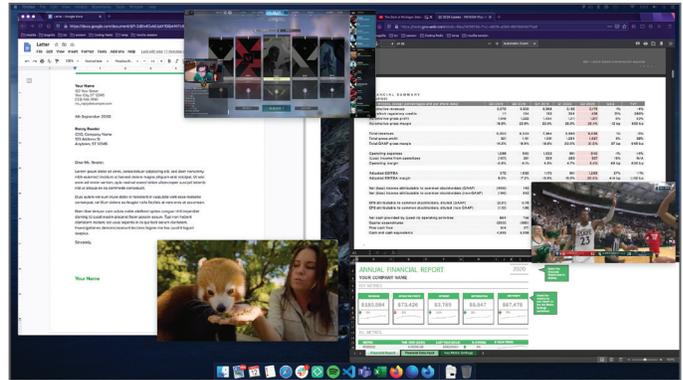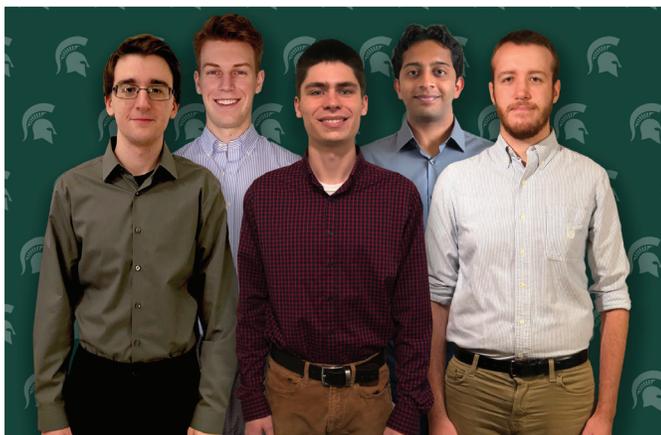
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MSU Federal Credit Union
Member Digital Help Center

Founded in 1937, Michigan State University Federal Credit Union provides a variety of financial services to students, faculty and staff at Michigan State University and Oakland University. With over 288,000 members, it is the largest university-based credit union in the world.

MSUFCU provides an outstanding customer experience. A critical part of the customer experience is self-service, where customers should be able to find information and answers to their questions at any time of the day or night.

Our Member Digital Help Center serves as a comprehensive "one-stop shop" for MSUFCU customers to get their questions answered, learn about personal finance, and find resources that MSUFCU offers.

Our Help Center includes FAQs, videos and general information pages. Users can find information by searching for what they would like to learn, filtering the results, and browsing by category. The Help Center also provides access to various forms of personalized assistance, such as a chatbot and live chat with an MSUFCU employee by messaging or video chat.

A key characteristic of our Help Center is the wiki-style structure. On each page, select terms are hyperlinked and redirect the user to a page containing a definition and information about that term. Every page also features a "recommended" section, which contains links to other relevant pages. For example, information about gap insurance is recommended in FAQs about auto loans.

Our search and recommended articles are constantly updated by user feedback through a thumbs up/thumbs down rating system. Based on user feedback, our system provides continually improving service to MSUFCU's customers.

Our Help Center is designed using PHP, HTML, CSS and JavaScript. The back-end database is managed with phpMyAdmin.
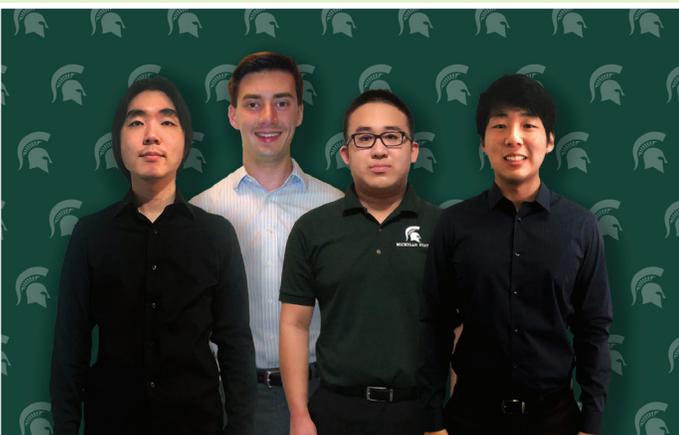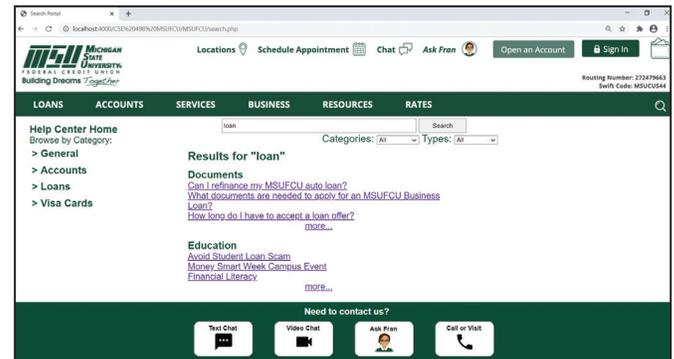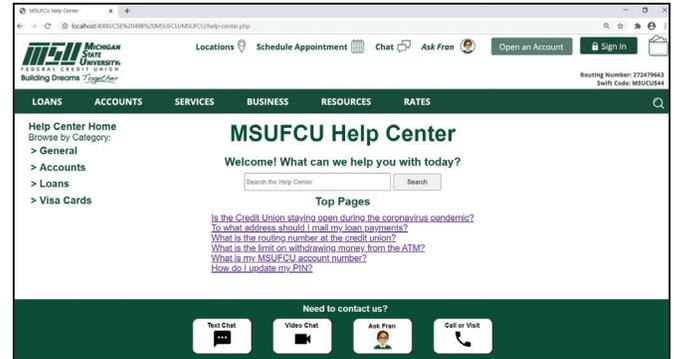
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Proofpoint
Leveraging SPAM to Make Bold Societal Predictions

Proofpoint, headquartered in Sunnyvale, California, is a cybersecurity company that provides solutions to top research universities, banks and over half of the Fortune 100 corporations. Proofpoint protects sensitive data across every domain including email, the web, the cloud, social media and mobile messaging.

Proofpoint shields their clients from millions of spam emails per day. By analyzing terabytes of email data, Proofpoint can predict future cyber security attacks and prevent them before they happen, increasing the security and reliability of their system and the web.

Our Leveraging SPAM to Make Bold Societal Predictions project utilizes the large amount of spam Proofpoint collects to make predictions about real-world events.

Our system analyzes the data from spam emails via various machine learning techniques and all spam emails about a particular topic to look for underlying patterns that might indicate the outcome of a particular event.

The trends in spam data, as well as any predictions our system makes, are available to be viewed on our web dashboard. The dashboard highlights any interesting data trends, and also various predictions, including the 2020 presidential election, stock prices and consumer sentiment.

Proofpoint analysts use our dashboard to help predict future cyber security risks before they happen, allowing them to provide superior security to their clients.

Our back end runs locally on Proofpoint's secure data server to collect information stored in spam .EML files and anonymizes the data so that customer privacy is protected, while still not compromising the information we are able to use from those files.

Our web dashboard consists of a React front end with a Django and SQLite back end that is being hosted on an Apache web
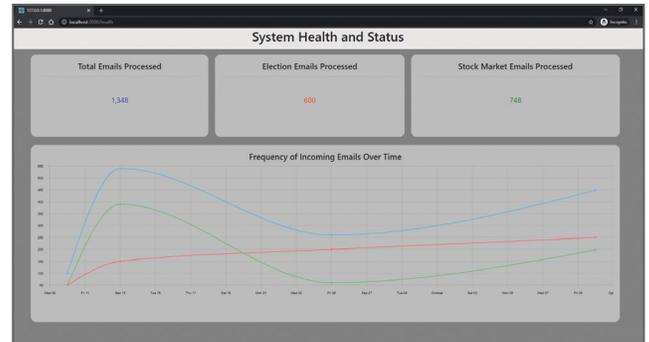
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Quicken Loans
Rally OKR (Objectives and Key Results)

Headquartered in the heart of Detroit, Michigan's financial district, Quicken Loans is the United States' largest online mortgage lender. For ten years they have been a Primary Mortgage Organization, and for seven years a Primary Mortgage Servicing company.

As Quicken Loans has expanded, they have developed the need for a system that not only tracks goals, but also makes them actionable and measurable. This is accomplished by breaking them down into smaller parts, referred to as Objectives and Key Results (OKRs).

Our Rally OKR software is a fully responsive web-based application that allows users to easily track objectives and key results in an intuitive user interface. Dynamic progress updates within the application improve company-wide awareness of overarching goals.

With our system, users can view and manage objectives and key results based on their role, which is determined by Quicken Loans. Upon login, users can view their current assigned objectives and key results, as well as their progress and user's role.

When selecting either an objective or a key result, its details are displayed. Furthermore, users can write comments to discuss updates for the goals. They can also grade key results anonymously, which then updates the associated objective's grade as well. Objectives are easily viewable in a hierarchy within the application, showing how each objective is linked.

Our system allows Quicken Loans' teams to track their progress toward goals in smaller, more manageable pieces and visualize them intuitively, as well as increase company-wide communication, increasing productivity in the workplace.

Our application uses .NET Core for the API with a MySQL database hosted on Amazon Web Services. The API is hosted on Heroku, and the front end utilizes ReactJS.
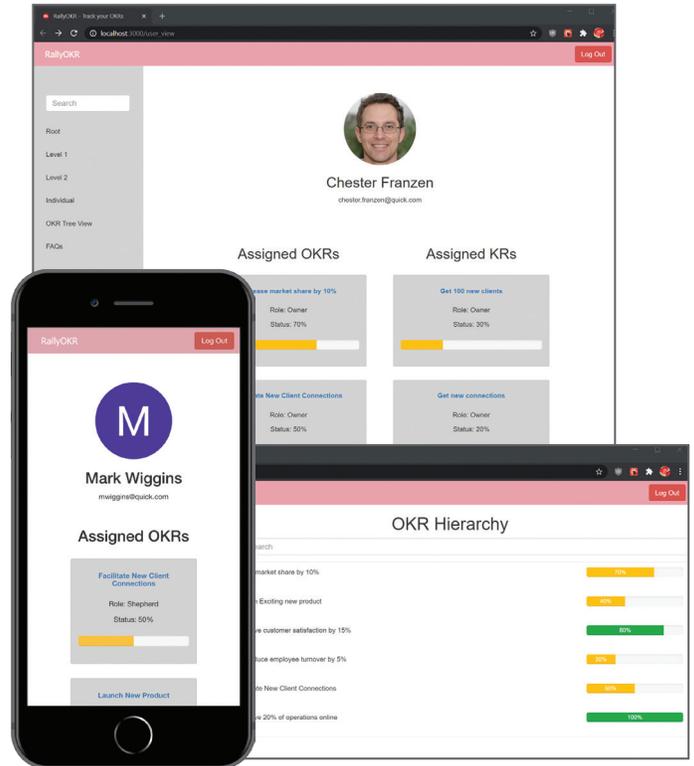
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TechSmith
TechSmith Video Summarizer

TechSmith provides software that empowers people to communicate more effectively by easily creating visual content such as images and video. Their flagship products, Snagit and Camtasia, are used by more than 30 million people worldwide.

The way people learn has drastically changed over the past year, with more and more people relying on video content for education. With this shift to online learning, a few glaring issues with video teaching arise, namely that long videos are hard to navigate and find relevant information.

Our TechSmith Video Summarizer solves this issue by automatically segmenting and summarizing any video into small, easy-to-navigate segments that the user can search through and view based on what they are seeking.

The TechSmith Video Summarizer uses speech-to-text techniques to extract the words spoken in a video into a transcript. We then use natural language processing (NLP) on this transcript to extract the main ideas of a video, and to find segments of a video all related to the same topic.

Our Video Summarizer then segments a video into a number of "mini" videos based on our NLP. Each of these segments has its own summary and keywords. Users can effortlessly determine if the content in a given segment is what they are seeking.

Allowing users to browse keywords and summaries of video segments gives them complete control over their learning and video watching experience. Users are no longer burdened with searching through hours of video to find the particular content of interest.

The front end of our web application uses HTML, CSS and React while the back end uses C# and .NET Core framework. The web application and SQL database are both hosted on Microsoft Azure. FFmpeg is used to render and break down the video.
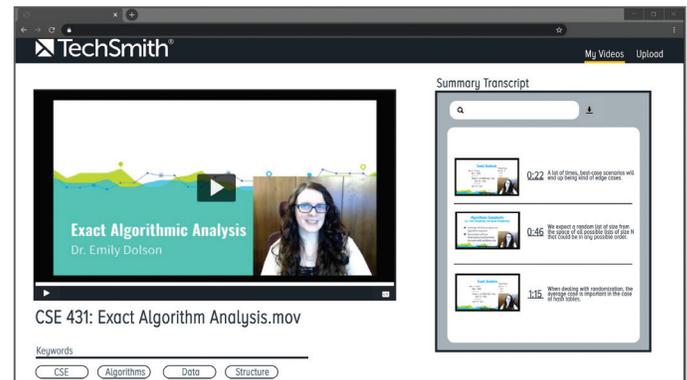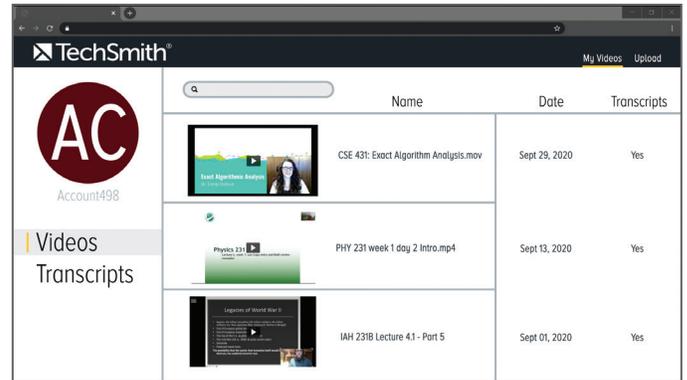
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United Airlines
Mobile GSAP and QC Audit Center v2.0

United Airlines is the world's second-largest airline, currently operating approximately 2,200 flights a day out of 250 airports around the globe. To maintain its fleet of aircraft and ensure successful and safe flights, it is crucial to identify and resolve safety concerns and hazards.

With safety being a top priority for United Airlines, many reports and audits need to be filed each month. However, form submissions can only be done on a desktop computer. The user must jot down notes using pen and paper before heading inside the facility to file the report. Mobile GSAP and QC Audits is a mobile version of the desktop application designed to be used in the field.

Our Mobile GSAP and QC Audit Center v2.0 builds off the first version by providing more features. In addition to both types of reports supported by the previous application, our system supports three more. These include Management Observed Compliance and Hazard Assessment (MOCHA), Line Operation Safety Assessment (LOSA), and Aircraft and Ground Damage Reports (ERS). Each user has access to reports based on their department and position.

Our updated mobile application is more user-friendly, allowing a simple and intuitive submission process, including autofill name, drop-down lists, and the ability to include a real-time photo or video. Furthermore, users can create, save, and submit forms as they inspect an aircraft or audit an employee. Upon saving a form, users can access it later through a mobile device or desktop for review and editing.

Reports and audits can now be quickly completed in real time using our system. This reduces time spent filing reports and expedites the entire process.

Our front-end software is written using Swift for iOS and Kotlin for Android, while our back-end system is written in Python and Django for the API and a Microsoft SQL Server database.
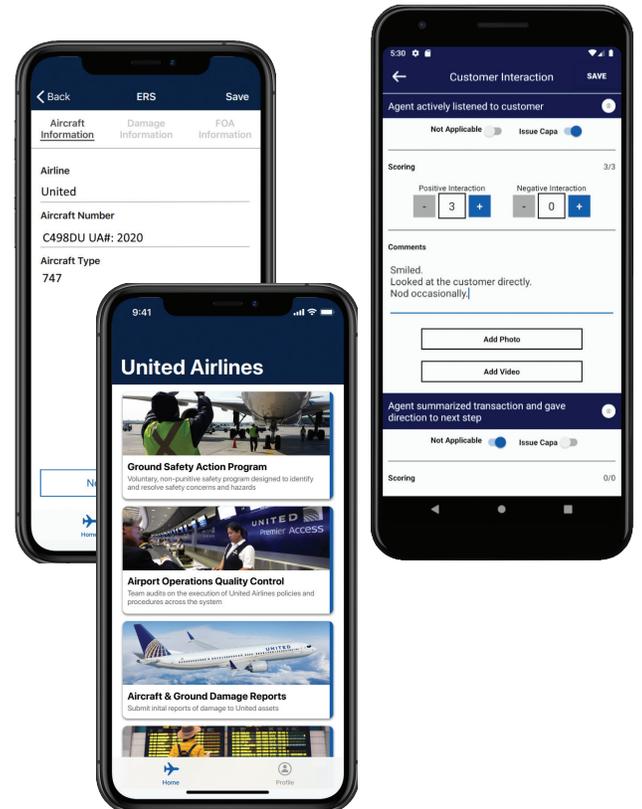
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United Airlines
Airport Lounge Management System

United Airlines is a major international air carrier, currently operating 2,200 flights per day from 250 airports. United Airlines operates 45 United Club lounges as well as Polaris lounges in Chicago, Houston, Los Angeles, Newark and San Francisco, with several more on the way.

Currently, qualifying customers from United and partner Star Alliance airlines can access amenities such as dining, daybeds and showers in the Polaris lounges. Because of the large number of amenities offered at these lounges, lounge staff spends a lot of time maintaining them.

Our Airport Lounge Management System is a web application that automates certain tasks, allowing lounge attendants to spend more time interacting with customers.

Waitlists for amenities are managed by our system, which sends a text message to customers when their spot is available. A dashboard also displays customer flight information and departure time, allowing staff to adjust the waitlist order accordingly. Real-time updates are provided on the status of individual amenities, including which are in use, being turned over, are vacant, and out of order.

Our system also provides actionable data to United and lounge staff - performance metrics that indicate how efficiently each lounge is being run and strategic data on the type of customers who use these lounges.

Waitlist management and amenity status tracking is automated, allowing lounge staff to spend more time with guests and improve customers' enjoyment of these lounges.

Our Lounge Management System is built with ReactJS, ASP. NET Core and a Microsoft SQL Server database. The web app is accessed through a United-owned iOS device and is hosted on Windows server in AWS.
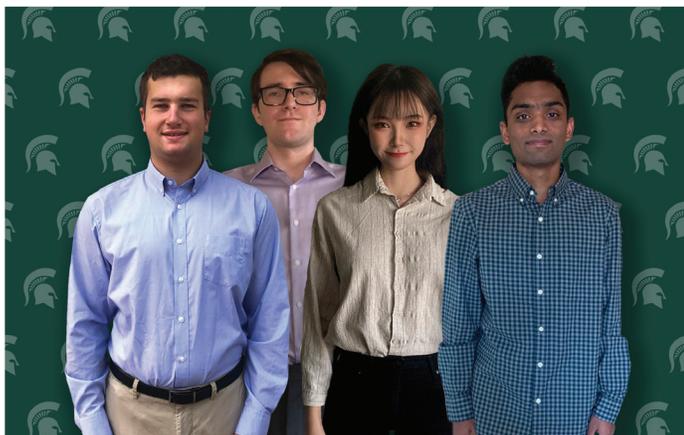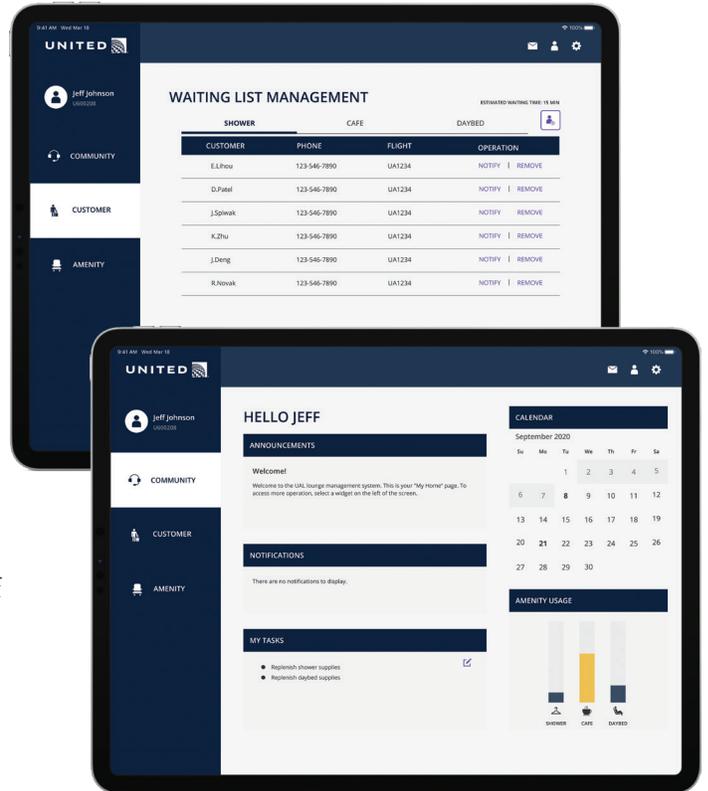
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United Airlines
Tech Ops Training Content Management System

United Airlines is a major international air-carrier, currently operating 2,200 flights per day from 250 airports. Running an airline requires diligence in all logistical and technical aspects to ensure the best flight experience for "Every customer. Every flight. Every day."

Within United Airlines, the TechOps training division is responsible for teaching United's technicians how to operate and maintain their wide variety of aircraft. To supply this training, United Airlines currently maintains a vast encyclopedia of training documents and videos.

Our Tech Ops Training Content Management System provides access to this encyclopedia of training content through an intuitive desktop and tablet-based website.

When users access our website through United Airlines' employee portal, they are greeted with customized media content based on their previous activity. Our analytics determine videos and documents most relevant to an individual's needs. Users are shown media that is popular with all users and media that is recommended by United Airlines administrators.

Employees may leave feedback on media items and the system as a whole. This feedback is provided to United Airlines administrators who can change their activities accordingly.

United Airlines administrators can create, edit, and remove media content from the site's collection. Furthermore, they can approve comments, view feedback, and flag media items. Flagging a media item displays that item on the homepage for a subset of users selected by the administrator.

Our system is optimized for both tablet and desktop use and is built using ASP.NET Core 3.1, Angular 10, Node.js, an Entity Framework, and an Azure SQL Database. The web app is hosted on a Microsoft IIS server.
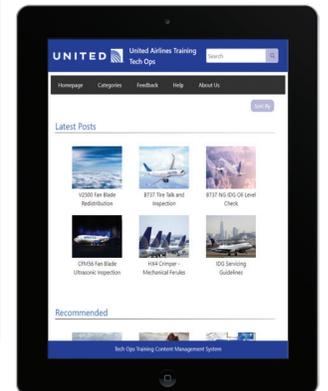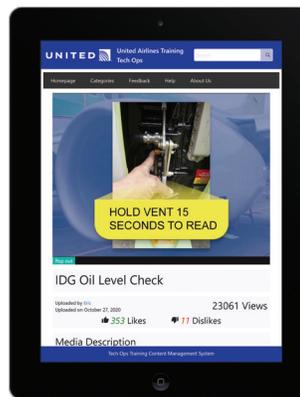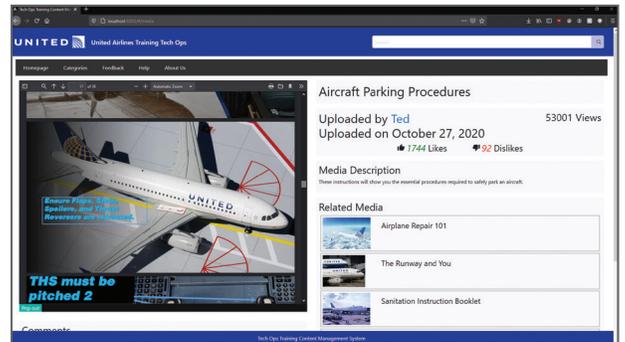
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Urban Science
Purchase Score Application

Headquartered in Detroit, Urban Science is internationally renowned for providing data-driven, science-based solutions to problems in the automotive, health, and retail industries. With strong industry knowledge, Urban Science provides meaningful solutions for companies from GM to Ferrari.

One of the problems that Urban Science seeks to solve for its clients is how to convert sales leads (potential buyers of a product or service) into successful sales. With Urban Science's lead-scoring solutions, clients are able to have leads displayed as low, medium, or highly likely buyers. Though this feature is extremely useful, there is currently not a straightforward solution for allowing dealers to easily input lead information and receive a score for a specific lead.
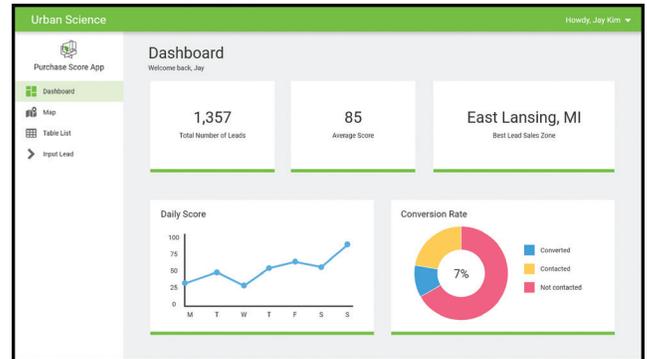
Our Purchase Score Application is a web platform that provides an easy and straightforward interface for dealers to input lead information, score each lead, and create informative reports based on lead information.

Our Purchase Score Application is designed to allow users to easily navigate our website and view pertinent information. Dealers can input their collected lead information automatically through a file upload, or manually with just the press of a button.

After lead information has been provided by the dealer, analytics reports can be easily generated to suit the dealer's needs. These analytics reports present dealers with metrics and useful information to help in the sales process. High-quality leads and suggestions are shown in an engaging and easy-to-read format.

Each report helps increase dealer sales with information on top leads, lead trends, and other helpful metrics.

The Purchase Score Application front end, built on React and Node.js, makes calls to Urban Science's APIs for scoring capabilities. The information produced using the Purchase Score Application is stored in a SQL Server database.

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Vectorform
Self-Improving Assistant

Since its founding in 1999, Vectorform has provided a platform to a wide variety of organizations wishing to solve big problems with inventions emerging at the forefront of technology. This approach has grown Vectorform into a truly worldwide company, with offices in Seattle, Detroit, Mumbai, and Hyderabad. Vectorform combines expertise in hardware engineering, internet of things, augmented and virtual reality, and user-experience focused design to their solutions.

Our Self-Improving Assistant platform acts as a framework to allow Vectorform and its clients to easily create custom support chatbots for any purpose. The system is explicitly designed to be domain-independent, meaning it can be configured to provide automatic customer support in any field, if provided with relevant training data. Each chatbot resides in a Microsoft Teams channel, allowing easy access to anyone in an organization.

To achieve these goals, the chatbot framework takes loosely structured text (FAQ pages, call logs, product manuals, etc.) and uses natural language processing to extract the underlying answers to any questions from a customer seeking support.

Our system is designed to learn and improve as it experiences more customer interaction. As customers ask questions and get answers, the quality of the feedback is collected and analyzed. If a correct solution is achieved, the bot learns that a particular solution is valuable to a certain type of question.

If the user's question is not answered, the user is directed to human support, and the steps the bot took in its unsuccessful resolution of a question will not be repeated for similar questions.

The Self-Improving Assistant uses a C# .NET Core application which queries Microsoft Azure Cloud Services. MS Cognitive Services processes user queries. The MS Graph API handles permissions and support channels.
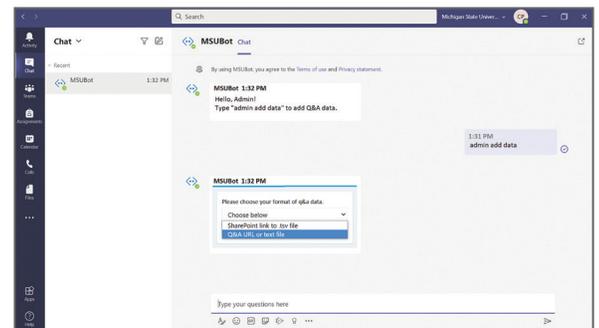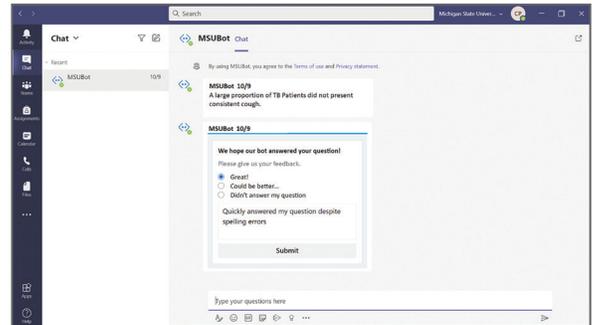
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Volkswagen Group of America
VW Car-Net Electric Vehicle Route Planner

Volkswagen Group of America is the North American operation headquarters and subsidiary of the Volkswagen Group, one of the world's leading automobile manufacturers. They are comprised of 8,000 employees in the United States and sell their vehicles through a 1,000-strong dealer network.

Electric vehicles are one of the latest innovations in the automobile industry. Volkswagen, who just released their first electric vehicle, the ID.4, want a way to show potential customers the benefits of electric vehicles compared to gas powered vehicles as well as address and correct some of the common misconceptions many people have about electric vehicles.

Our VW Car-Net Electric Vehicle Route Planner application is displayed in Volkswagen dealerships and educates potential car buyers about the benefits of buying an electric vehicle.

A major concern many buyers have about electric vehicles is the car's range and charging options available on the road. Our application generates driving routes for gas vehicles and electric vehicles that stop at charging stations. Buyers can compare these various routes with respect to route length, route path, fuel costs and carbon emissions.

Our application also allows for extensive customizability including sliders to adjust starting battery charge, climate control, temperature and weather conditions to account for the effects these factors have on battery consumption.

Our Electric Vehicle Route Planner helps assuage the fears of potential electric vehicle buyers by showing them that their daily routine will have minimal disruptions, and significant benefits if they switch to an electric vehicle.

Our Electric Vehicle Route Planner is developed as an Android application that utilizes API calls to handle route altering attributes and route generation. Our application is written in Kotlin.
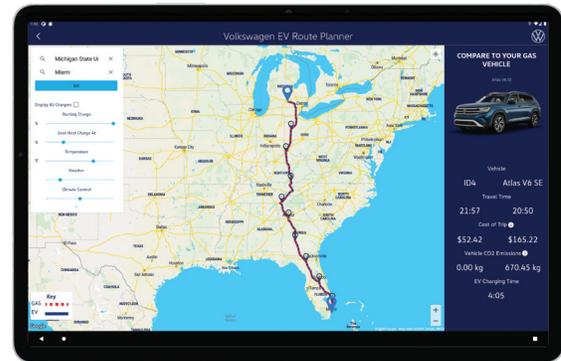
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Projects Spring 2021

Amazon
Sentinel

Founded in Bellevue, Washington in 1994, Amazon is a Fortune 500 company that provides a variety of services to customers and is the world's largest cloud services provider and online retailer.

Amazon's online marketplace handles millions of orders every day from over a million unique sellers. With an operation of such magnitude, it is inevitable that some buyers and even some sellers engage in fraudulent activities. Amazon's current fraud detection system requires individual sellers to detect and recognize unusual activity themselves, which can lead to undetected fraud and extra work for sellers.

Our Sentinel system helps to resolve these issues by automatically detecting fraudulent transactions and notifying sellers in real time.

Sentinel uses machine learning to detect patterns from historical transaction data, then applies these patterns to all incoming transactions to determine when a fraudulent transaction has occurred. Once Sentinel has detected fraud, the seller is notified immediately.

Using our mobile application, sellers can manage all of their orders, including any fraud detected by Sentinel. Our application gives sellers options to freeze their account, cancel any fraudulent orders, or to explore more transactions before making a decision.

Sentinel helps Amazon sellers save time and money by detecting and mitigating fraudulent purchases automatically, giving sellers much needed peace of mind.

Our machine learning models are built using Amazon SageMaker, trained on user data and transactions stored in Amazon S3. AWS Lambda is used to detect instances of fraud in real time and the cloud platform sends a notification to the merchant's mobile device. The iOS application is written in Swift.
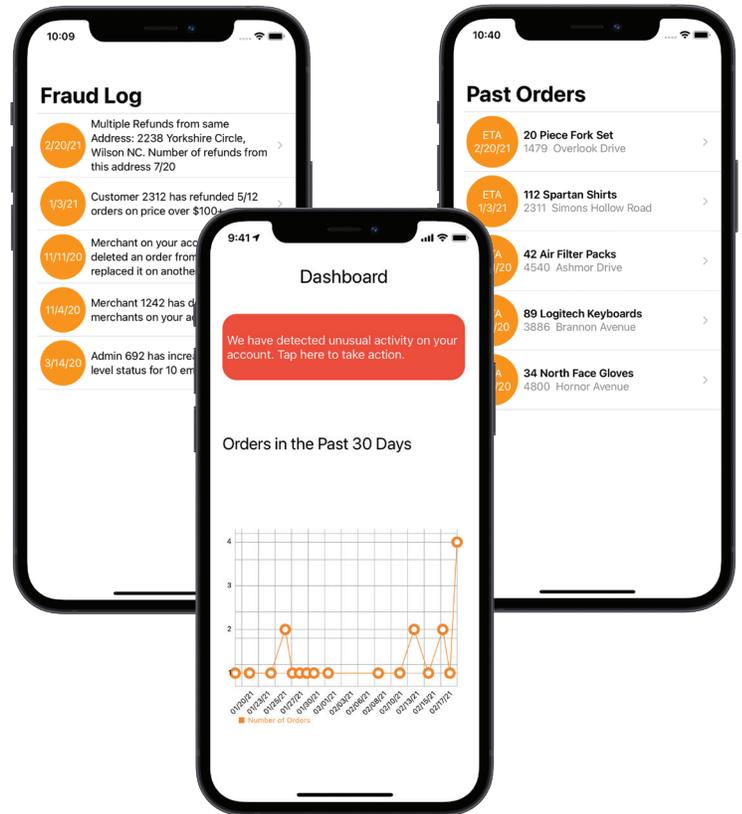
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Anthropocene Institute
Siting of Marine Turbines for Power Generation

The Anthropocene Institute is a non-governmental organization that drives and facilitates innovation in clean energy to address the urgency of climate change. It supports start-ups and universities to develop emerging and disruptive energy technologies that are clean, safe, and reliable. It is also involved in raising public awareness for 'one-cent' electricity as a key goal for the power grid.

The Anthropocene Institute has started to look at aquatic turbines as a promising new type of renewable power generation. However, a major hurdle to overcome is determining the best placement for the turbines that maximizes their power generation and minimizes costs.

When placing a water turbine, many factors have to be considered, including the depth of the water, the velocity of the current, and the distance to the nearest coast. However, current data on oceans and rivers are incomplete, meaning accurate predictions for turbine placement cannot be achieved.

Our Siting of Marine Turbines for Power Generation project solves this issue by using machine learning to fill the gaps of the currently incomplete data. Our models use historical data to predict the water conditions in any area without sufficient data, allowing Anthropocene to give accurate power generation and cost estimates for turbine placement.

Our web application provides an easy-to-use interface designed for policymakers, utilities, and investors who are looking for clean energy solutions. Users simply search for an area, and our application provides them with statistics and recommendations relating to the cost and power generation potential of a water turbine placed in that area.

The machine learning models were developed in Google CoLab, using the scikit-learn library. The user interface is a Flask- based web server with data visualization by the Google Maps API.
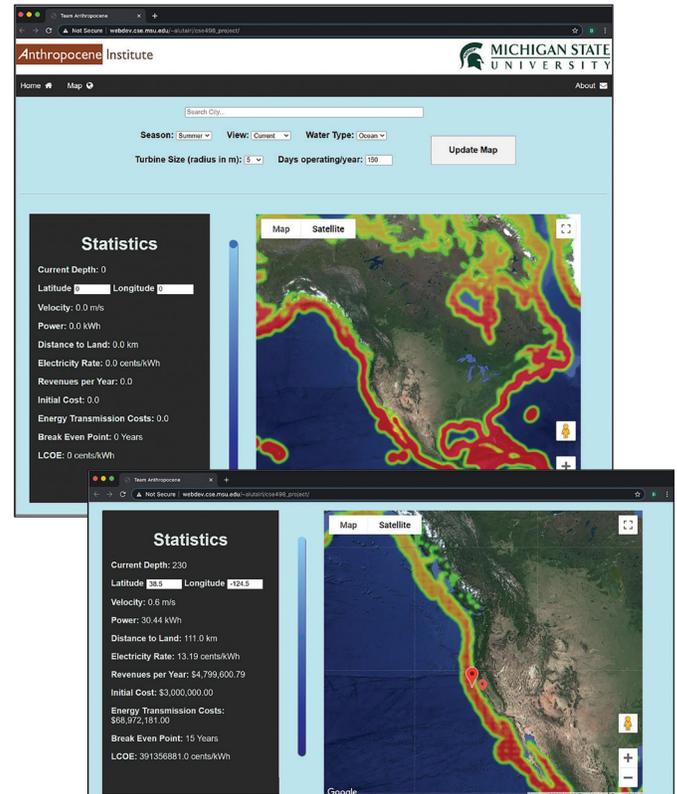
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Authoritek
Crisis911 Emergency Communication

Authoritek is a software consultant company that provides their clients with purpose driven software that manages their data. They are located in the Grand Rapids area of Michigan.

Emergency situations are stressful, both for those involved and their loved ones. During times like these, the ability to stay informed and inform others is key. It is vital that the user experience is quick and simple so precious time is not wasted.

Our software, Crisis911 Emergency, is used in schools when staff encounters an emergency situation that puts them or students in danger. With the help of this application, users can notify loved ones or other faculty in the school of the situation. The software is simple yet effective in notifying individuals who need to be updated about a crisis.

The application has a live feed for crisis updates that can be sent out to whomever the user wants to notify. That feed contains updates of the situation and continues to be updated until the crisis has ended. This allows parents, faculty and guardians to be aware of what is happening in the school without being present.

A key element of Crisis911 Emergency is the ability to have live updates on the crisis at hand, which the user can select when starting the event. This means users in the system receive all information and everyone can be kept safe.

A mobile and web application are available for users to operate, with both being able to indicate the start and end of a crisis. Users can choose who they want to notify by adding contacts through the web application and creating new events to further articulate what type of crisis is happening. Crisis911 Emergency keeps all parties updated about crises in real time.

Our application's back-end database is managed through Google Firebase. The design and functionality of the application is accomplished with React Native, ReactJS, HTML, CSS and Twilio.
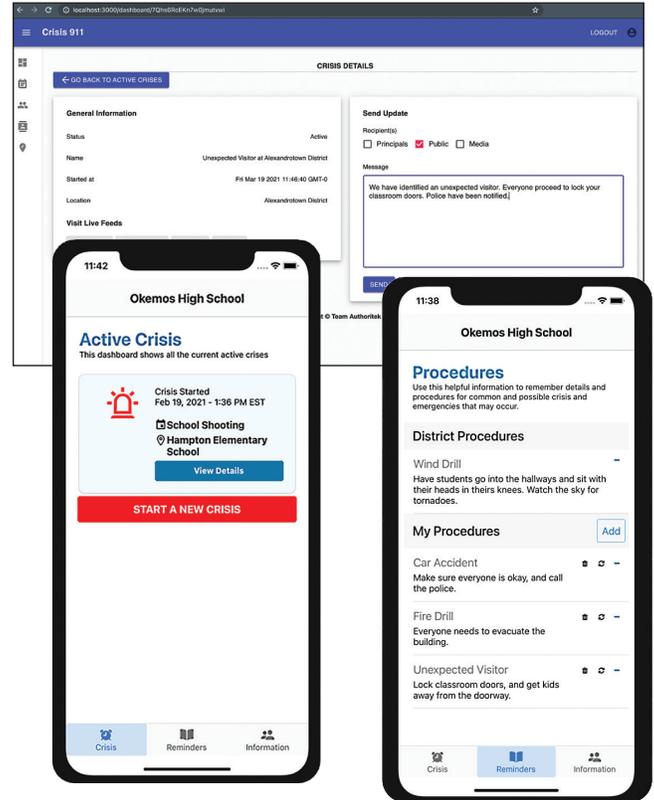
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Auto-Owners Insurance
AO Sidekick

Auto-Owners Insurance is a Fortune 500 company headquartered in Lansing, Michigan. With over 48,000 licensed insurance agents in over 26 states, Auto-Owners provides automotive, home, life, and business insurance to nearly 3 million policyholders.

With over 600,000 visits to their website every month by a broad base of both agents and policyholders, Auto-Owners strives to ensure that their products and resources are easily accessible to everyone, including those who have difficulty using a web browser.

The AO Sidekick is an accessibility application offered to users trying to access the Auto-Owners' website. The Sidekick directs users to pages across the site quickly and simply using only voice input.

When a user arrives at the AO Sidekick homepage, they are greeted with links to common pages on the AO website, as well as a description of what the Sidekick can do. From there, the user can navigate to the Sidekick page where the communication interface is located. Here, the user can see their correspondence with the Sidekick displayed in a text message style format. At the press of the microphone button, Sidekick interprets the user's query and directs them to where they want to go.

If the user's intent is unclear or their request too vague, our system asks follow-up questions for clarification.

Information gathered from this phase is stored and displayed in an intuitive manner on the dashboard page. AO employees can use this insight to facilitate further improvements in the future.

AO Sidekick is developed as a web application hosted by Azure. Azure provides the MS SQL database as well as the LUIS natural language processing API. The front end was developed using HTML, CSS and the ReactJS framework.
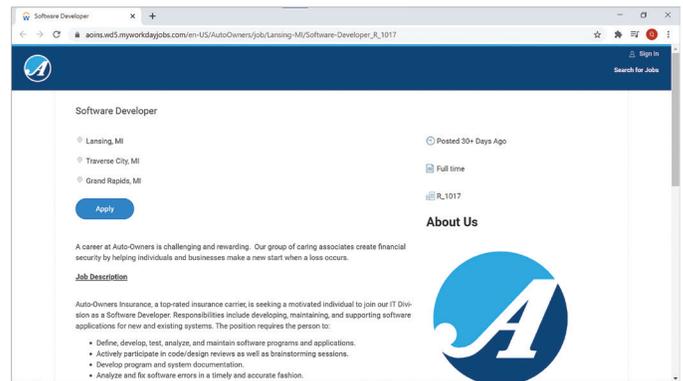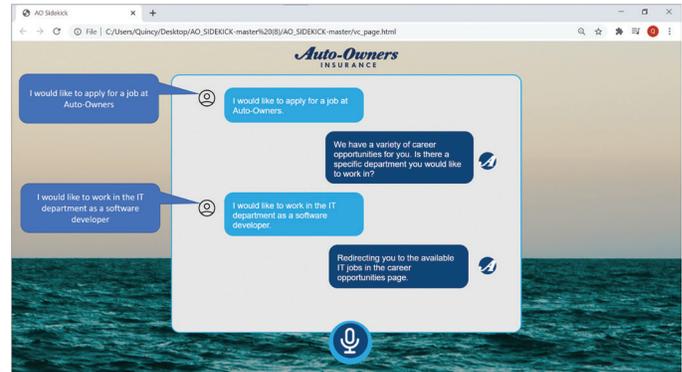
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Bosch
Real-Time ADAS Endurance Run Data Validation

Bosch is a German-based international technology and service provider employing approximately 395,000 employees worldwide. Bosch specializes in integrated technology, such as smart devices and automobiles, generating almost 72 billion euros in sales in 2020.

Bosch uses test vehicles to gather data from vehicle systems as they drive along a variety of roads and highways across the world. These vehicles collect data from specific areas where the driving environment generates conditions of special interest to Bosch engineers for use in improving their systems.

Presently, these vehicles drive and gather data for up to a month before the data is delivered en masse to engineers for analysis. This timeline generates a problem when the data contains errors of some form and the test vehicle is distant from where the error occurred.

Our Real-Time Advanced Driver Assistance System (ADAS) Endurance Run Data Validation platform solves this problem by ensuring the data collected is error-free in near real time. Any time errors are present in the data collection, the test vehicle drivers are notified, allowing the driver to repeat the test in a timely manner.

Our software system achieves this goal by validating data upon completion of the data collection process, utilizing a computer embedded within the test vehicle. This verification program then communicates with other infrastructure to allow drivers and engineers to view the status of this verification software in a web application. The website contains capabilities which allow individuals to easily view and update information regarding the verification process.

Our Real-Time ADAS Endurance Run Validation platform uses a Python script to read and validate vehicle data as soon as data collection has been completed. A web application then allows users to view, update, and manage the data validation process.
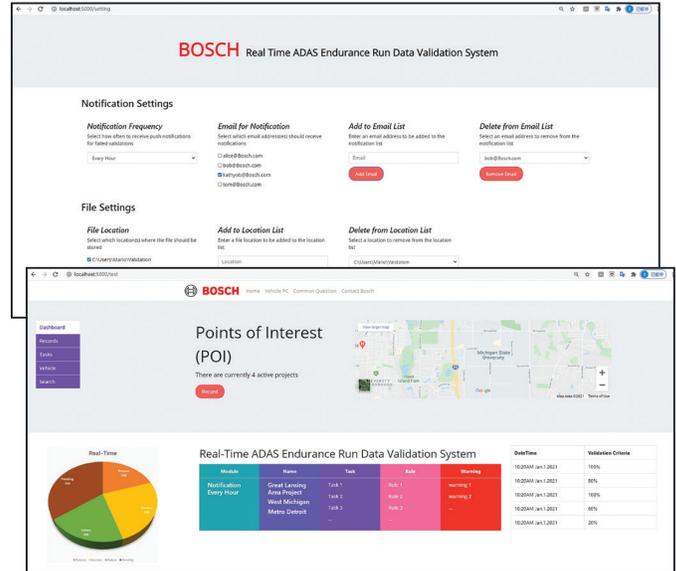
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CSAA Insurance Group
Insurance Coverage Wizard

CSAA Insurance Group (CSAA) is a subsidiary of AAA Insurance operating out of Walnut Creek, California. CSAA offers auto, homeowners, and other lines of insurance in twenty-three different states and the District of Columbia.

Purchasing insurance is a time-consuming and difficult process that often leaves customers annoyed and confused. CSAA is always innovating insurance and wants to educate their customers on possible insurance coverage options.

Our Insurance Coverage Wizard is a tool designed to help customers quickly and easily receive a personalized insurance quote. The wizard consists of a series of questions to help it learn more about the user and their insurance needs. The wizard then guides the user through various types of insurance coverages to better inform the customer of their insurance options.

The Insurance Coverage Wizard includes eight steps, each of which educates the user about a specific coverage and how it pertains to them. Using the knowledge from the wizard, users can confidently build an insurance plan that is right for them.

Our wizard is accessible from any computer or smartphone and is designed to keep the user engaged with the material to provide them the best experience possible.

To achieve the best experience for their customers, CSAA collects data on how users interact with the wizard. This data is available to CSAA employees in a PowerBI dashboard. With this user engagement information, CSAA constantly updates the wizard to improve the insurance buying process for their customers.

Our software uses a ReactJS front end to communicate user input to the .NET Core back end. Data is hosted in a MySQL database. All of this is deployed on an Amazon EC2 Instance.
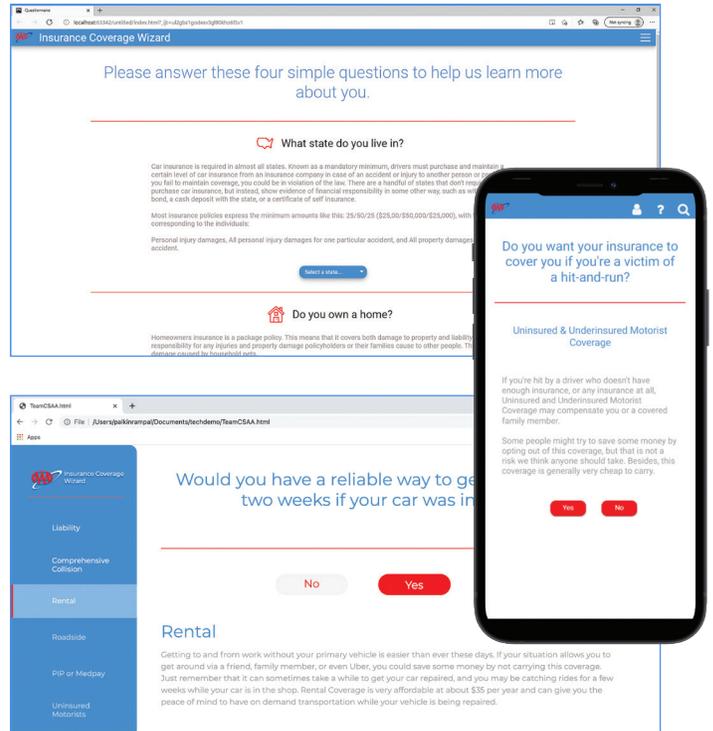
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CSAA Insurance Group
Eye in the Sky: Intelligent Drone Video Processing

CSAA Insurance Group, headquartered in Walnut Creek, California, is a AAA insurer, one of the top insurance groups. They offer auto, homeowners and other lines of insurance in twenty-three states and the District of Columbia.

One major area of CSAA's business is home insurance. With the increasing number of wildfires in recent years, it is important for both the insurer and homeowners to accurately assess property risk from wildfires.

Our Eye in the Sky: Intelligent Drone Video Processing project uses drone footage to determine high fire risk areas as well as the risk of specific homes, providing key information for CSAA in determining the necessity of action and risk associated with insurance throughout California.

To determine the fire risk of a home, a drone is sent to collect images of its surrounding area which are then sent to our web application, Eye in the Sky. Our application processes these images using computer vision to detect objects of risk, including things like dry brush, concrete and trees. Based on the different properties of surrounding objects, the property is given an overall fire risk score.

CSAA employees use our web dashboard to assess the overall fire risks of potentially vulnerable areas. A large coverage map allows employees to easily view the fire risk of large areas, as well as the specific fire risks of an individual property.

Based on these fire-risk scores, employees can take appropriate action either by providing recommendations based on the surroundings to mitigate fire risk or investigate further using drones or by an in-person inspection.

The front end of our Eye in the Sky project is written in React, HTML and CSS. The back end is written in Python using Flask to link the two. MongoDB is used as the database and the entire web application is hosted on AWS.
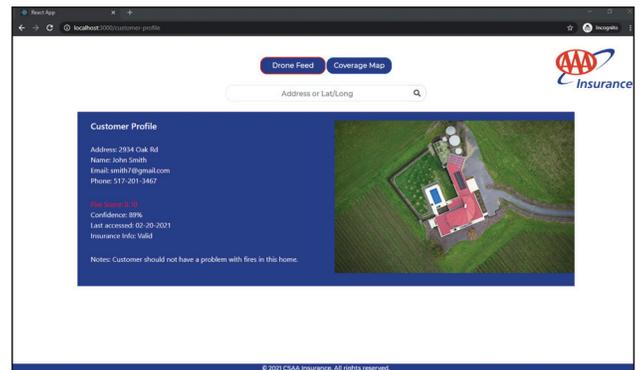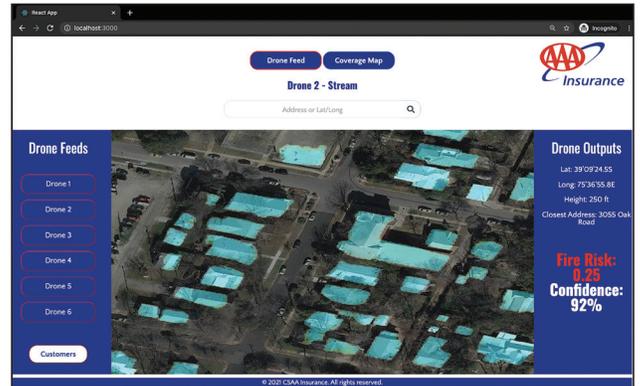
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Delta Dental of Michigan, Ohio and Indiana
Smart Dental Benefit Recommendation Engine

Delta Dental is the largest dental system in the United States, which operates two of the nation's largest networks of participating dentists. Delta Dental provides dental and orthodontic coverage to more than 78 million people in all 50 states, Puerto Rico and other U.S territories, including small businesses, government entities, and professional organizations of all kinds.

Underwriting is the process of how Delta Dental determines the best dental insurance plan for their clients. In addition to crafting insurance plans for new clients, underwriters also spend a significant amount of time recommending benefit changes for current customers. This time-consuming process requires aggregating data from several sources and significant domain knowledge to properly recommend benefit updates.

Our Smart Dental Benefit Recommendation Engine helps automate the underwriting process to improve benefits for customers and save underwriters time.

Our system uses machine learning to look at historical data to help determine the best insurance plan for a given individual or family. Based on this analysis, our system recommends additions or reductions to the customer's current plan.

Our web dashboard aggregates all of the information needed by underwriters in one convenient location, including the benefit changes recommended by our machine learning model.

Using our system, Delta Dental underwriters can offer customers faster and more efficient service, and it allows them to focus their valuable time on more important issues.

The recommendation and prediction algorithms are written in Python in Jupyter Notebook, the web application is written in ReactJS. Our data is hosted on Snowflake from Delta Dental's Microsoft Azure databases. Docker is used to containerize our engine and host it on Microsoft Azure.
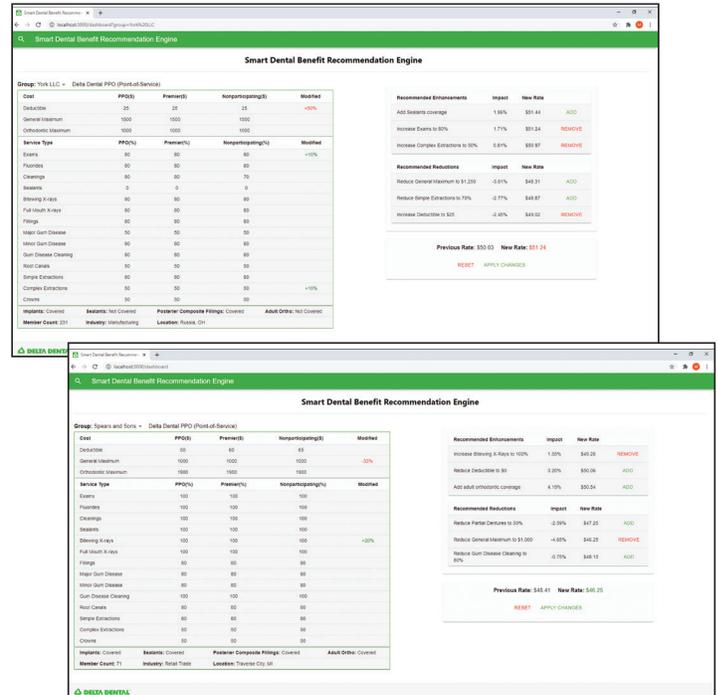
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Delta Dental of Michigan, Ohio and Indiana
Rule Engine Command Line Interface

Delta Dental is the nation's leading provider of dental insurance, serving more than 80 million Americans, with the core purpose of advancing the oral health of their customers, partners and consumers. Delta Dental of Michigan, headquartered in Okemos, Michigan, is at the forefront of utilizing rule-based solutions within their business operations and intelligence, with over 15 years of excellence in this domain.

When a Delta Dental developer wishes to engineer a rule-based solution, a non-trivial amount of setup must be completed first. Prototyping and testing of rule-based solutions are slowed down significantly by the setup process.

Our Rule Engine Command Line Interface provides an intuitive and interactive interface to Drools, the rule-based computing engine that Delta Dental's developers use on a daily basis.

Using our software, developers interact with every part of the Drools engine. The interface is organized into various modules, each of which handles a core function of rule-based computing. Our modular design makes it easy to update or even swap out various components when Drools is updated, or new software is needed.

The Rule Engine Command Line Interface streamlines the development process for rule-based computing, saving Delta Dental a significant amount of time and resources.

For the convenience of Delta Dental developers, our software functions as a command-line shell program. Our software is written in core Java, and therefore runs on any computer that has a Java runtime environment. The external libraries, including the core Drools library, and build process are managed by Maven. Version control and collaboration management were provided by Gitlab.

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The Dow Chemical Company
Improving the Performance of the Corporate Computer

With over a century of experience, Michigan-based Dow is a global leader in the innovation, creation, and distribution of specialty chemicals, advanced materials, and plastics. As a large company with 54,000 employees worldwide, Dow has a massive collection of computers and devices which employees use. The computers are of varying operating systems, models and generations. Dow collects computer usage and performance data on the computers in order to efficiently use their resources.

Our Improving the Performance of the Corporate Computer system analyzes the data so that events such as application crashes, blue screens and application hang times can be minimized. Data analysis reveals the optimal parameters for computers so that Dow employees can determine which are best to use. Data analysis also reveals applications most susceptible to crashes so that potential workflow improvements can be made.

Using the collected data, our system uses a machine learning model that predicts the performance of a computer given a set of properties.

We developed a web application where employees from Dow can visually input computer specifications and other parameters. Then, the application runs this input through our machine learning algorithm and visually displays the result for the employee to see.

This helps Dow easily determine whether it is worth investing money to upgrade or purchase different computers or components. Employees can use the web application to determine whether they should make changes to their system and what the expected outcome would be. In the long run, this helps Dow be more efficient with costs and its employees be most productive.

Data analysis is conducted using Python in Jupyter notebooks. The machine learning algorithm is developed using Python and Microsoft Azure. The web application is developed in Python Flask.
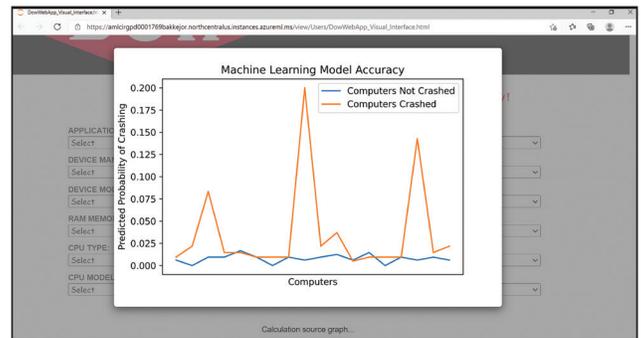
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Ford Motor Company
Ford Team View

Ford Motor Company is a multinational automotive manufacturer headquartered in Dearborn, Michigan, with operations in over 125 countries and a worldwide workforce of 199,000 employees. Ford designs and manufactures a full line of cars, trucks, SUVs and electric vehicles under both the Ford and Lincoln brands.

Ford is committed to promoting a work environment that supports and benefits from collaboration across multiple teams. However, due to the COVID-19 pandemic, team collaboration has been made more challenging. Instead of working side by side, teams are now working in their own private residences, making it difficult to locate other teams or make contributions to their projects.

Our Ford Team View web application provides a convenient way for users to locate other teams by either searching for a team name, advisory number, or an individual. Once a team is found and selected, their team profile is displayed.

In the team profile, a user can see every team member and their contact information, any incidents and issues the team is facing, the projects the team is working on, and a hierarchical chain of team members to contact when an issue arises.

Our application also allows users to search for a project by either entering an API name, base path, or contributor. When a project is clicked on, a user can view the number of times code was added to the project, the project's build and deployment history, and the contributors to the project.

Team View makes it easier for teams to collaborate and work together while working remotely, thereby increasing productivity.

The front end of our web application is created with the REACT framework, while our back end uses the Spring framework. Our application uses a MongoDB to store the team profiles and project information, which is retrieved by a REST API.
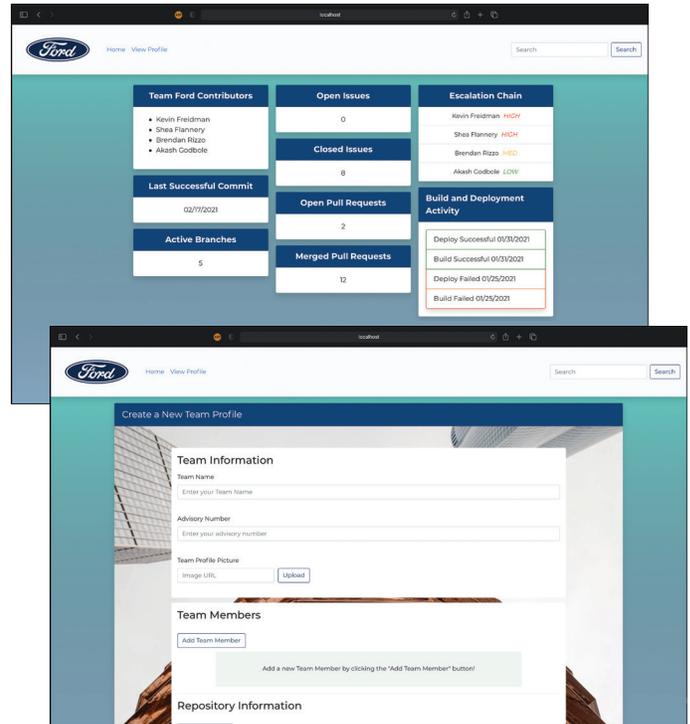
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General Motors
Malware Reverse Engineering Platform

General Motors (GM) is a multinational automotive manufacturer headquartered in Detroit, Michigan. GM is ranked #18 on the Fortune 500 for total revenue and is the largest auto manufacturer headquartered in the United States.

GM is committed to maintaining corporate security and the security of their customers. For this reason, effectively sharing information about malware and indicators of compromise within their organization is critical.

Our Malware Reverse Engineering Platform is a web application that provides a unified and easy-to-use interface that allows users to submit suspicious samples for analysis.

These samples may be files the user already has, or they may be scraped from web sources. The user can submit local files by either dragging a file and dropping it into an indicated box, or by selecting a file. They can submit a website to scrape by simply entering the URL and selecting the start button.

The analysis returns a report about the sample's behavior, such as what files it modifies, what it attempts to do on the network, and other potentially malicious activities. The report is visible within the interface after the analysis, and the user may download the report to their local machine. The report is also automatically sent to their organization's database for storage and for other members to view.

This platform automates and greatly simplifies a currently manual process that requires the user to interact with multiple programs. This gives GM's security analysts greater flexibility and efficiency in analyzing malware and sharing results.

The malware analysis incorporates Cuckoo. The samples and analyses are stored in a Malware Information Sharing Platform (MISP) instance. For integrating these tools, we are using the PyMISP library. The web interface uses Flask built off of Adobe XD.

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Herman Miller
Scout 2.0: Dynamic Data Visualization for Dealers

With over 100 years of experience, Herman Miller is a globally recognized provider of furnishings, related technologies and services headquartered in Zeeland, Michigan.

Herman Miller uses the Atlas Suite, an online suite of applications meant to make their users' experience as fluid as possible. Users leverage an application called Scout in the Atlas Suite to help potential customers visualize ideas, select commercial furniture and textiles, and build custom proposals.

The underlying data in the application, like clicks and hits, are monitored and recorded. However, substantial analysis of this data has not been done and potential insights were going unrealized.

To overcome this, our Scout 2.0 application dynamically visualizes the data for users through various interactive models.

The customer acquisition tab displays website traffic throughout the month, week, and day. Any user can hover over the diagram to get more specific data on all of the different tabs.

The popular content tab displays the projects and products views. The user can use the pagination feature which allows them to move back and forth between the most and least viewed items.

The customer locations tab provides insight into the geographical data recorded by Scout, ranging from country to region to city. Knowing this information gives dealers a better understanding of the state of their sale.

Our models provide various ways to visualize the data and help users understand different variables such as when and where the product is viewed, and the projects and products views. This aids dealers in selling products to customers, improving productivity.

The front end of Scout 2.0 is built through Visual Studio Code using AngularJS. The back end is implemented using several Amazon Web Services, including Lambda, Simple Storage Service, AppFlow, and Athena.
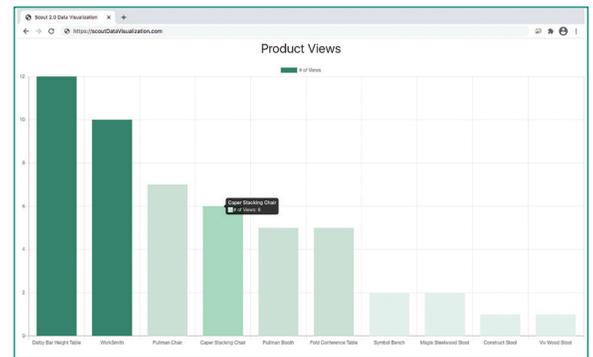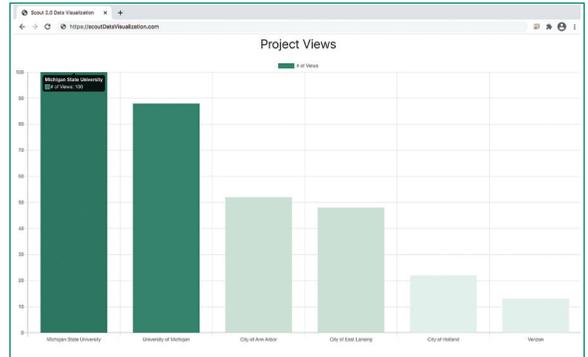
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Learning A-Z
Definition Station Word Matching Game

Founded in 2002, Learning A-Z is a technology company dedicated to expanding literacy through an extensive collection of thoughtfully designed educational tools. Catering to grades PreK-6, Learning A-Z's resources assist a wide variety of learners.

In the age of COVID-19, Learning A-Z's devotion to creating engaging online resources has become more crucial than ever. As a forward-thinking company, Learning A-Z is always developing new ways to keep students of many different abilities and interests excited to learn.

Our Definition Station Word Matching Game is a web game that teaches and reinforces vocabulary to children. The game empowers students to further their education in spelling and definition recognition. In addition, our game is customizable to fit the diverse needs of students at many different learning levels.

Upon beginning the game, a deck consisting of ten vocabulary words is created. The student is presented with one definition at a time until they complete all ten words in their deck or until they make three spelling errors.

The student is given a few seconds to process each definition, at which point train cars carrying letters begin rolling down the train track. The student is tasked with using switches to control the train cars' routes to the train station. A round is won when the student leads the train cars to the station in the correct order, meaning their word matches the definition and is spelled correctly.

Students choose their difficulty level from the home page before they begin playing. Parents, teachers, and older students can use the advanced settings page to further customize the difficulty.

Our game teaches new words and definitions to students in a fun and interactive way.

The software for this game is developed using JavaScript for the front end, which communicates with a MySQL database via PHP.
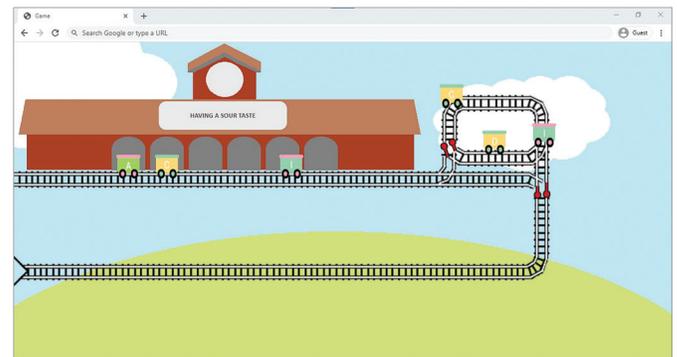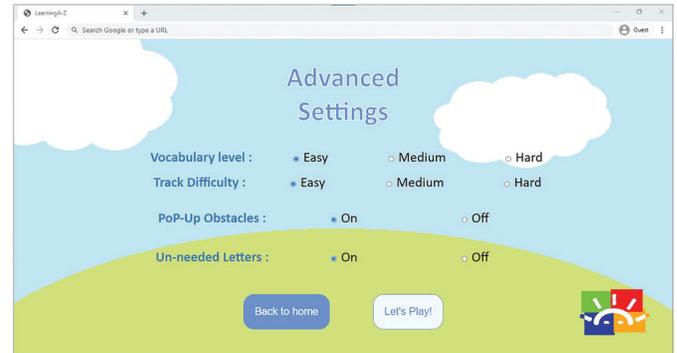
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Lockheed Martin Space
SmartSat™ Heterogenous Computing in Space

Lockheed Martin, headquartered in Bethesda, Maryland, is the largest defense contractor in the world and receives $60 billion in revenue annually. Lockheed Martin Space is a division of Lockheed Martin which specializes in building and deploying satellites and spacecraft for both commercial and military use.

The SmartSat software infrastructure, designed by Lockheed Martin Space, facilitates the development and deployment of software for spacecraft, which have historically leveraged all the power of the flight computers running the software that is responsible for operation of the spacecraft with little room to spare. Now that more powerful computers are available for the space domain, there is additional capacity that can be leveraged.

Our SmartSat™ Heterogenous Computing in Space system enables data to be processed on the satellite, reducing the need to send information over slow network connections. This reduces the bandwidth usage of the satellite by keeping raw data in orbit.

Because a satellite has significantly less computation power than computers on Earth, our system introduces clever hardware allocation schemes that can speed up image processing times on the satellite. One such optimization includes taking advantage of the wide variety of computers that exists onboard the satellite to run multiple applications at the same time.

Our system constantly analyzes the available hardware on the satellite, then assigns different SmartSat image processing applications to the hardware based on the best available option at any given time.

Our system reduces the time it takes to analyze data from satellites and ensures that the hardware onboard is used to its full capacity.

We use SYCL and Vitis to accelerate OpenCV computer vision applications on CPU, GPU and FPGA hardware.
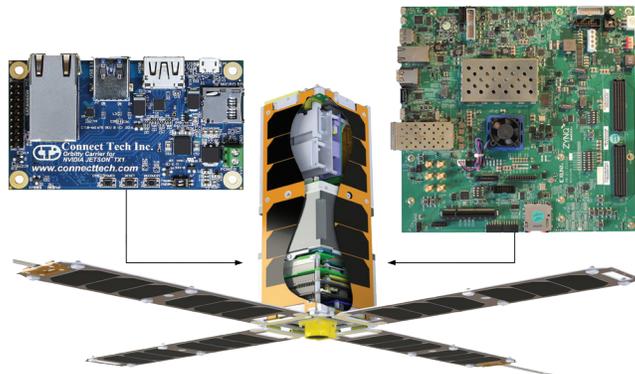
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Malleable Minds
Improving Access to PreK-12 Educational Opportunities

Malleable Minds is an emerging startup building the world's most extensive collection of PreK-12 programs, from the arts to the sciences, so students can further develop academic, interpersonal, and communication skills. Malleable Minds is breaking barriers to educational opportunities and empowering families to create a tailored educational roadmap for their children, leading them to bright futures.

Malleable Minds continually strives to bring the best user experience when designing their application. They currently have a review aggregator for educational programs.

Our Improving Access to PreK-12 Educational Opportunities project builds many features on top of the existing review aggregator website and improves site performance.

The site's users benefit from several new additions. When a user creates an account, a walkthrough shows key site features. Users are kept up to date through customized notifications based on type of user profile, location, and what areas they are interested in. User surveys capture feedback about the site's features and potential future improvements.

Administrative users also gain additional functionality. The administrative workflow page allows for authentication of applicants requesting either a program owner or educator account.

Site administrators can view a user dashboard with details about how the site is being used. The dashboard provides data such as when users log in, search for programs, write reviews, and more.

Our enhanced site is more efficient, faster, and includes more features that enhance the user experience and track usage metrics and user feedback, allowing Malleable Minds administrators to continually improve the site.

Our software uses React on the front end and Python on the back end. We host our software on Amazon Web Services.
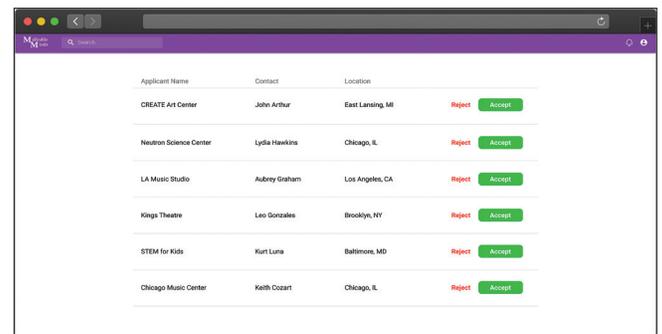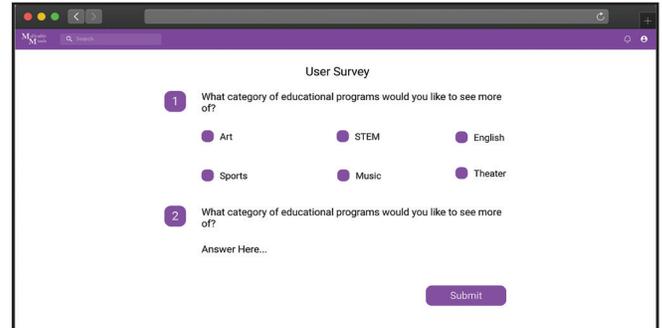
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Meijer
Meijer Store Wayfinding

Meijer is a major supercenter chain headquartered in Grand Rapids, Michigan, with locations throughout the Midwest. There are a total of 253 Meijer Supercenter stores, making it the 26th largest retailer in the United States. The Supercenter store layout is an idea that was pioneered by the Meijer Corporation, which combines groceries and department store goods all in one store.

Meijer is constantly at the forefront of innovation, especially when it comes to offering customers the optimal shopping experience. Because of the inherent size of Meijer supercenters, customers may find it difficult to locate the specific product they are looking for in an efficient manner. In addition, the layout of Meijer stores can vary greatly by location and are periodically changed, adding to shopper confusion.

Our Meijer Store Wayfinding functionality offers Meijer shoppers a solution to this problem by integrating an intuitive and easy-to-use navigation interface in the Meijer mobile application.

Using our mobile application, customers are given a full map of their Meijer store, including a dot showing their current location in the store. This is achieved using MIST wireless access points that Meijer is introducing to their stores.

In addition to this mapping feature, our application offers turn- by-turn navigation of Meijer stores. Users input an item or list of items into our application and are shown the optimal path through the store to each item on their list. Directions to each item are shown on the map screen, similar to how Google Maps works while driving a car.

Meijer Store Wayfinding enhances the customer experience of all Meijer shoppers and allows them to feel more in control of their shopping experience.

Our software is written in Swift and is integrated with Mist Access Points to get live location data of shoppers.
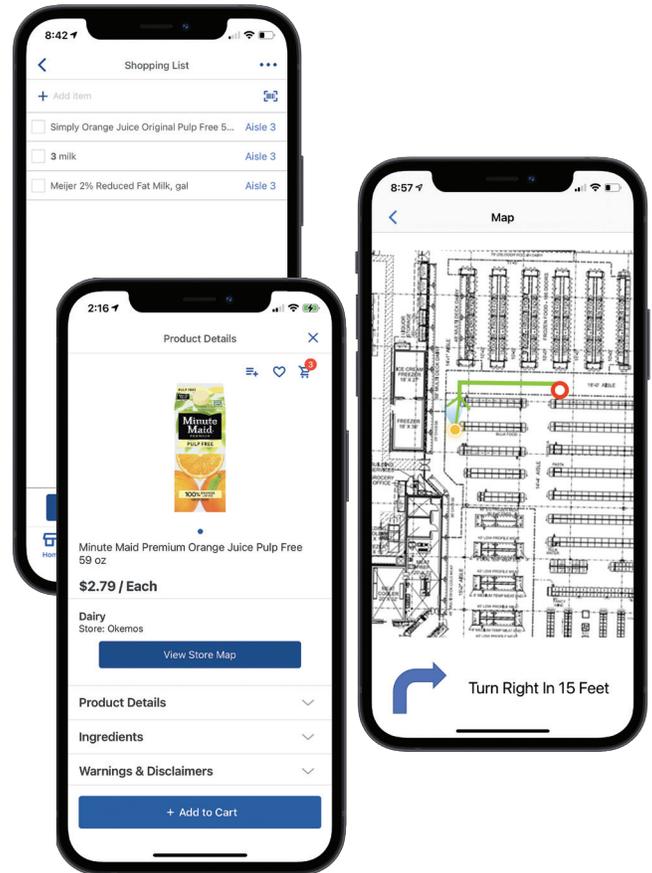
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Michigan State University Animal Science
Pesticide Management for Sustainable Vineyards

Michigan State University is a public research university boasting approximately 50,000 enrolled students. Originally founded as an agricultural college, the MSU Department of Animal Science remains a pioneer in agricultural research.

Michigan is home to a very large grape-growing industry. Vineyard owners and workers must cooperate to manage, track and control insect infestations and disease outbreaks as they arise.

Our Pesticide Management for Sustainable Vineyards system provides a solution for workers in both the field and in the office.

When a field worker opens the app on their Android or iOS device, they can immediately view upcoming tasks, such as spraying a new pesticide onto their crop. When performing these actions, pertinent information like weather conditions and GPS location is collected. While in the field, workers can take pictures of new infestations as they arise, reporting them to management.

Vineyard managers can view this information on our system webpage, as well as automatically generate records of pesticide use for the USDA or MDARD. They can view maps of their field with up-to-date information about current infestations and outbreaks, and assign new tasks to their workers to mitigate them.

Our system also calculates a risk factor for each pesticide based on the unique circumstances of each vineyard and field. This allows vineyard owners to select pesticides that are effective, sustainable, and safe for both their employees and their consumers.

Our software streamlines the process of identifying, mitigating, and reporting pests and chemical usage for the grape-growing industry, and creates a repository of information for further research into Michigan's ecology.

The Pesticide Management for Sustainable Vineyards back end is a server utilizing a LAMP stack. The application is written in PHP for web, Java for Android, and Swift for iOS.
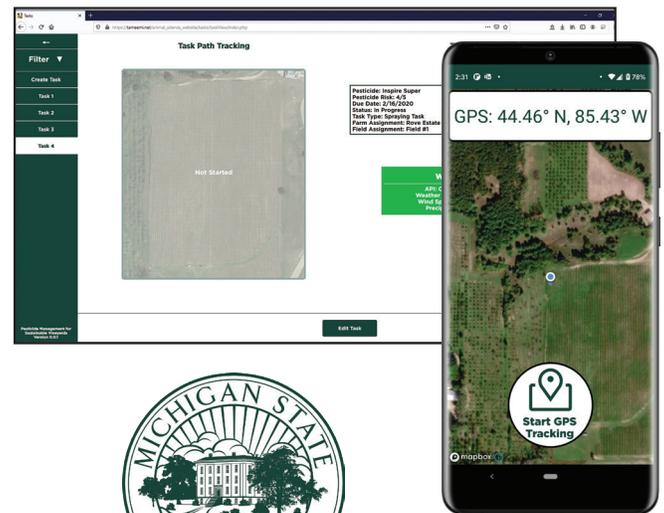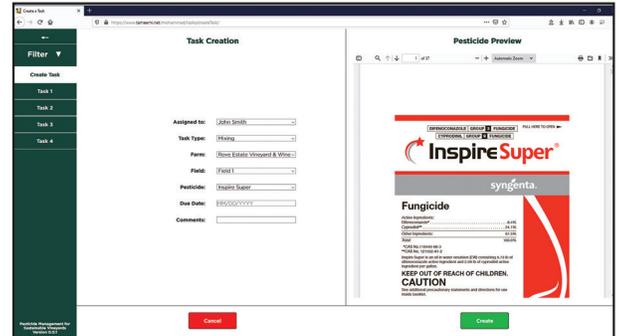
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Mozilla Corporation
Pushing Picture-in-Picture towards Perfection

M ozilla is the company behind Firefox, the world's leading open-source web browser with over 200 million monthly active users. Mozilla is a non-profit organization headquartered in Mountain View, California, that has long been on a mission to keep the internet open and accessible to all people to enrich lives and foster innovation.

Firefox has introduced many tools to help their users better manage their multitasking. At the forefront is their Picture-in-Picture (PiP) feature that allows multiple videos to be "popped" out of the browser into dedicated windows that are always on top of all other windows. PiP is ideal for taking notes during a lecture or even watching multiple YouTube or Netflix videos at once.

Since the release of Picture-in-Picture, many users have requested that the feature be expanded, improved, and pushed "towards perfection."

Previously, users had limited control over the PiP window when it was "popped" out of the web browser, which could lead to frustrations when trying to interact with the video.

Our Pushing Picture-in-Picture towards Perfection project mitigates these issues by giving the user greater control of their PiP windows and improves the overall user experience of Firefox's PiP.

Our additions to PiP include allowing captions in the PiP window and allowing for keyboard control of things like timing, volume and size, as opposed to forcing the user to use the mouse in the browser.

These additions reduce the need for the user to interact with the browser and allow for more seamless multitasking while using Firefox.

Running with multiple languages (C++, HTML, JavaScript), PiP lives within the Firefox codebase. However, as a feature, PiP is primarily based on HTML and JavaScript.
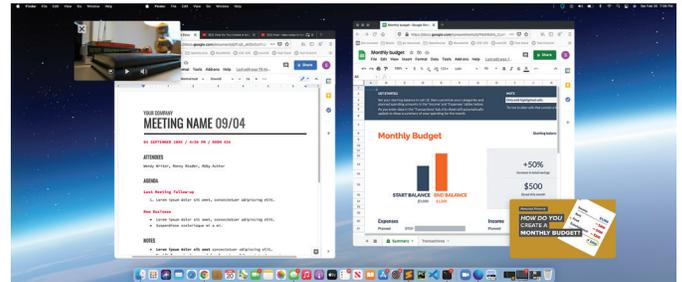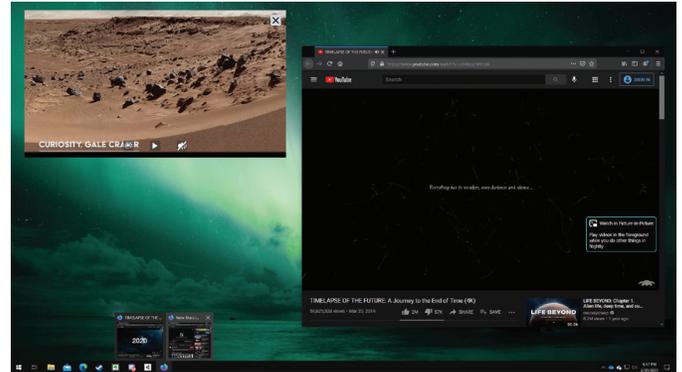
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MSU Federal Credit Union
Augmented Reality Financial Education

Founded in 1937 in East Lansing, MSU Federal Credit Union provides a variety of financial services to students, faculty and staff at Michigan State University and Oakland University. With 21 branches and over 300,000 members, it is the largest university-based credit union in the world.

MSUFCU provides a variety of financial education resources to its customers to ensure they are making the best monetary decisions. Our Augmented Reality Financial Education application serves to gamify saving money and provide encouragement to their customers throughout the process.

Our mobile app teaches customers about saving money through a new feature called goal journeys, which includes various savings goals that a user can choose from, such as saving for a beach vacation, paying off student loans, or buying a house.

After a user selects a goal journey, they are asked to set aside a certain amount of money for the goal, as well as determine what their overall savings goal is and how long they want to save. Once this information is gathered, our application offers detailed savings reports and their overall progress towards their goal.

As the user progresses towards their goal, they have the option of using our augmented reality view, which helps them visualize their progress towards their goal. For example, as the user saves money, the augmented reality view for the beach vacation goal journey shows the user with a beach towel, then with sunglasses and a surfboard, until they eventually reach their savings goal, and the augmented reality view shows them on vacation. This visualization of progress helps fully immerse the customer in their savings goal.

Our Augmented Reality Financial Education mobile app is built using Swift for iOS and Java for Android. The web app is built using ReactJS. The back end for all applications is built using PHP and PHPMyAdmin.
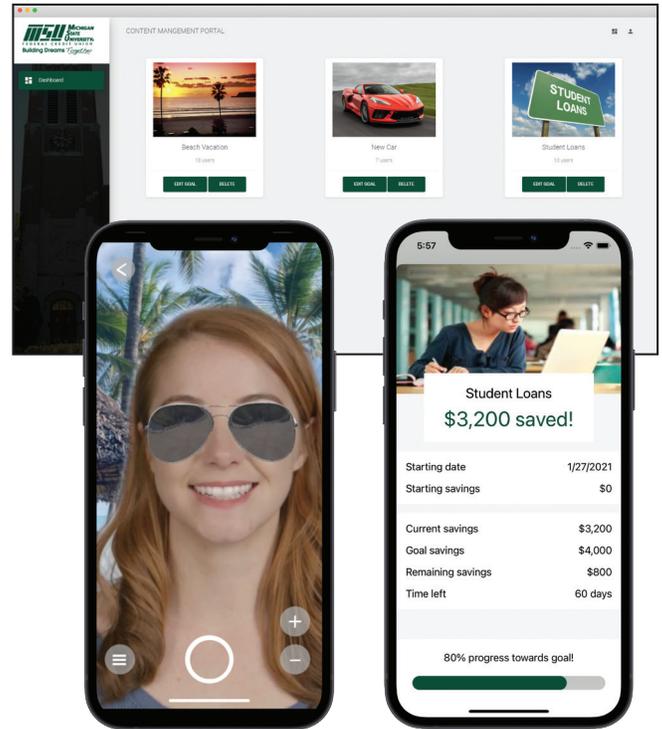
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Proofpoint
Predicting the Future through Spam Signal Intelligence

Founded in 2002, Proofpoint is a cybersecurity company based in Sunnyvale, California, that safeguards their clients and their clients' data from online threats. Proofpoint identifies and filters threats from email, the web, the cloud, social media and mobile messaging. They protect banks, research facilities, universities and numerous companies across the world.

To this end, Proofpoint has accumulated terabytes of spam and analyzed it to predict potential risks and provide improved security.

Our Predicting the Future through Spam Signal Intelligence system analyzes this spam email data for patterns to help users predict real-world events.

Our system sorts emails by topic and sentiment with machine learning, analyzes them for underlying patterns, then charts them against real-world outcomes to hone the predictive algorithms. These methods can be used to anticipate wide societal events such as election outcomes and stock market fluctuations.

The resulting predictions and data are viewable from our web dashboard. The dashboard can be configured to view statistics such as spam volume, general sentiment regarding a topic, changes in sentiment over time, and projected future sentiment.

Proofpoint analysts evaluating future risks use our dashboard to forecast potential events and take measures early on to ensure they are well-prepared to protect their clients. This allows Proofpoint to provide improved security.

Our back end runs a PostgreSQL database server to store information gleaned from the spam email files. We use Flair and scikit-learn for machine learning and an email parser to extract information from the spam.

Our web dashboard is built on the Django framework and Apache server. It displays information from the database through a React user interface.
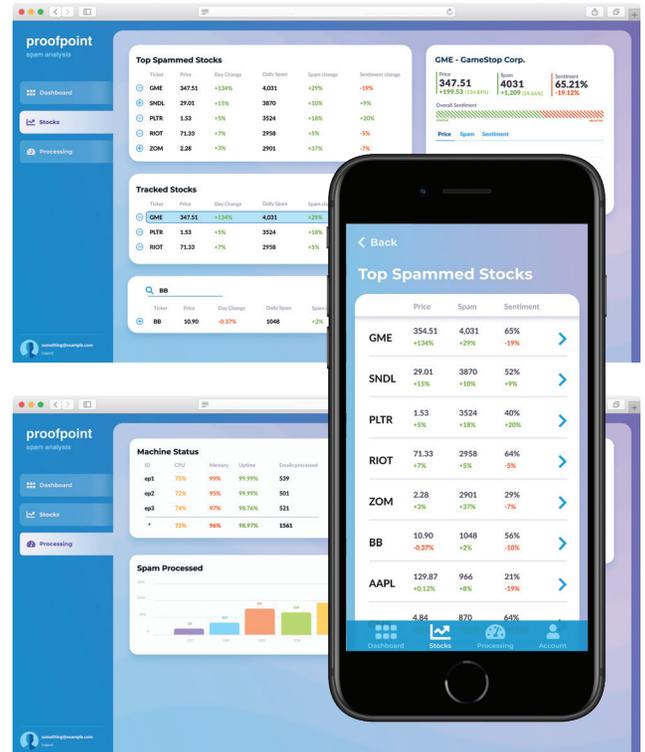
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Quicken Loans
Project Relo

Headquartered in the heart of Detroit, Michigan's financial district, Quicken Loans is the nation's largest online mortgage lender. They have been providing affordable mortgages and award-winning client service for more than 30 years.

Employee relocation can be complex and stressful, especially the home mortgage acquisition process. Unfortunately, enterprise relocation agents must complete this process manually for multiple employees concurrently. This can be time-consuming and leaves room for data entry errors.

Our Project Relo software is a web-based application that allows agents to easily store employee data and distribute it to partnered mortgage companies. Within our website, mortgage request update messages keep the agent and mortgage bankers aware of the requests' statuses.

Upon login, relocation agents can view their currently active employee relocations and mortgage requests, shown in the top artwork. They can add new relocations and requests to the website through a simple form.

When selecting an employee relocation, the details are displayed, shown in the bottom artwork. From here, the agent can create new mortgage requests and complete the mortgage process on the employee's behalf. Agents can select a mortgage request to view progress updates with timestamps. Completed relocations are archived and can be searched for by name or ID.

Our website also supports an admin user. They can add mortgage companies and agents into our software. If either of these users have their access revoked, their information is archived, and the admin can search for it by name or ID.

Our front-end web application is built with ReactJS while the back end utilizes Node.js, GraphQL and DynamoDB. All components of Project Relo are hosted on Amazon Web Services.
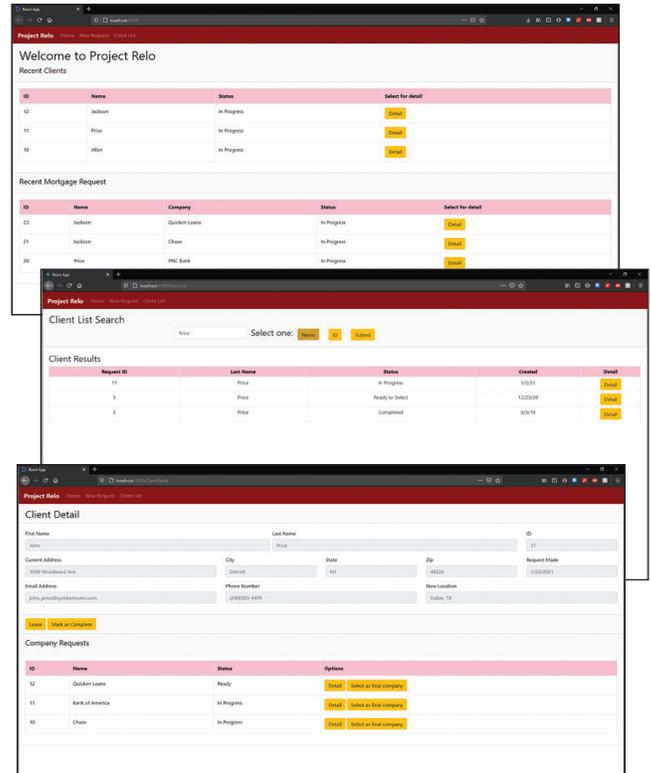
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Quicken Loans
Rocket DevRel Tracker

Headquartered in the heart of Detroit, Michigan's financial district, Quicken Loans is the United States' largest online mortgage lender. Rocket Mortgage was launched in 2015 to serve as Quicken Loans' online mortgage lending platform.

Rocket Mortgage recently created a Developer Relations team that participates, sponsors, and speaks at virtual or in-person conferences and events to help communicate supported products and services. This has resulted in the need to collect and share relevant information and data.

Our Rocket DevRel Tracker is a responsive web-based application that allows the Developer Relations team to track upcoming conferences, view submitted talk details for discussion, and store related personal media.

Users can view future conference details along with whether Rocket Mortgage has obligations such as operating booths or speaking at any given event. Conferences are stored so that ratings can be given to past events for leadership to evaluate if the team should return the following year.

Within our system, speakers can store, track and submit talk details for acceptance at conferences and events. The Developer Relations team reviews talk details and decides whether to approve them. Other users can then view accepted talks and their information, such as location and time.

Our system automates much of the work currently done manually by the Developer Relations team in order to free their time. This allows them to focus on the conferences and events themselves, improving efficiency and productivity.

Our web application uses Google's Firebase hosting platform for the API as well as the document-oriented database, Cloud Firestore. In addition, the front end of the application utilizes ReactJS.
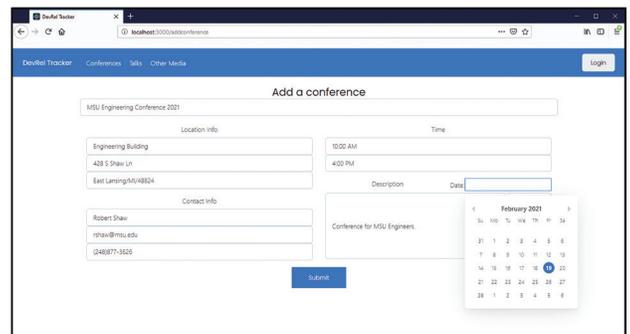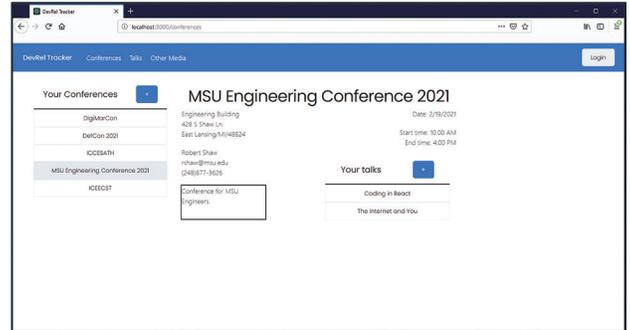
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TechSmith
TechSmith Answers

Headquartered in Okemos, Michigan, TechSmith provides software that empowers people to communicate more effectively by easily creating visual content. Their flagship products, Snagit and Camtasia, are used by more than 30 million people worldwide.

TechSmith also offers TechSmith Knowmia, a platform where content creators can upload and share collections of media for other users to watch. One common use case of Knowmia is that of instructor and student within an educational institution.

Instructors often upload large collections of videos for students to watch, such as a set of videos that covers a module within a course. Because there are such a large number of videos, students often find it difficult to find videos to answer their question, or a video on a particular topic.

Our TechSmith Answers platform provides a solution to this problem through an intuitive web dashboard that allows users to easily search and navigate large collections of media without any additional effort by video creators.

TechSmith Answers uses speech-to-text software to create subtitles for every video uploaded to our system. Using these subtitles, our system uses natural language processing to determine questions that can be answered by the video.

When a user searches for a video on a particular topic, TechSmith Answers directs them to the exact minute of a particular video that helps solve their problem.

Our system improves the learning experience of students by allowing them to spend their time studying instead of searching through videos for hours on end.

TechSmith Answers uses Microsoft Azure for data storage, speech-to-text generation, natural language processing, search, and sign-in. The front end is built using ReactJS, and the back end is built using .NET Core.
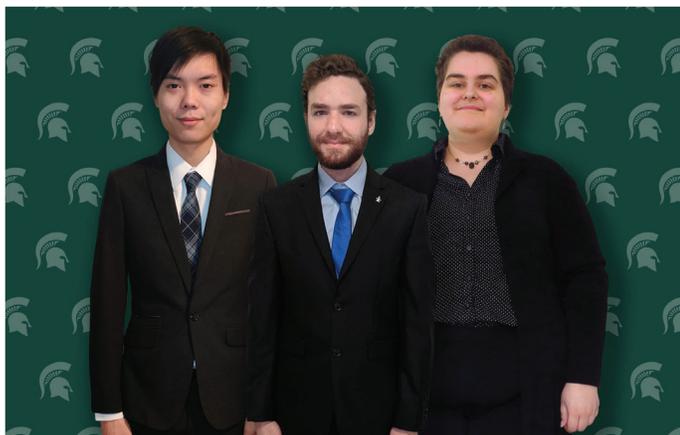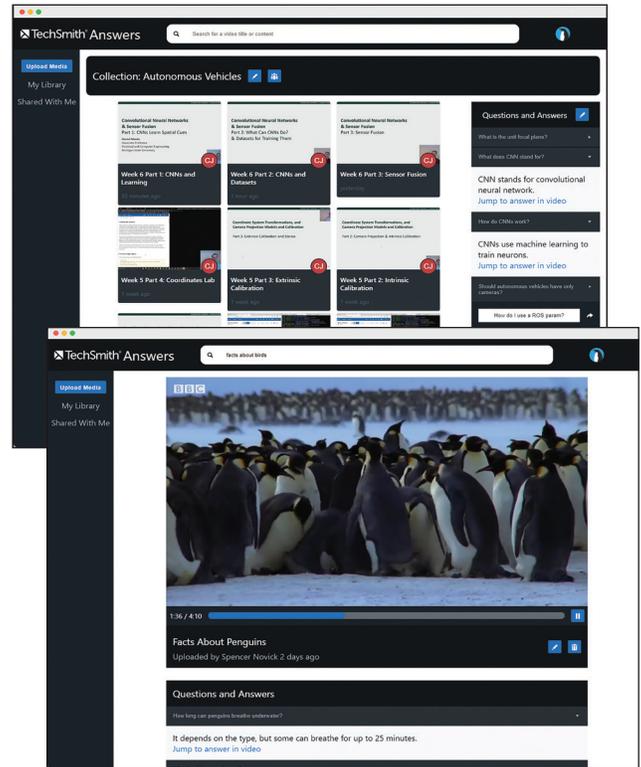
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United Airlines
Turn Management Analyzer

United Airlines, Inc. is a leading American airline headquartered in Chicago, Illinois. In 2019, United and United Express operated more than 1.7 million flights carrying more than 162 million customers to their destinations safely.

Safety is United Airlines' number one priority on every flight. An aircraft turn accounts for the time it takes for a series of safety procedures to be carried out by United Airlines' employees from when the aircraft arrives at the gate to when it clears for departure.

Auditors conduct live audits of aircraft turns to determine whether the arrival and departure steps are compliant or non-compliant per standard operating procedure. United Airlines is exploring ways to automate the recognition of some of these aircraft turn tasks.

Our Turn Management Analyzer automatically identifies and evaluates the aircraft turn using the video camera feeds at each airport gate.

When an aircraft begins a turn, our system uses computer vision algorithms to track any objects and people working on the aircraft to determine if they are compliant with all safety protocols and complete the proper steps for a safe aircraft turn.

If our system detects a task that is performed incorrectly, out of sequence, or any employee not following safety protocols, it flags this action for review by a United Airlines auditor who can evaluate the situation.

Our software helps auditors ensure that United Airlines always provides their customers with the safest flight possible.

The front end is written in HTML, JavaScript and CSS. The back end consists of a MySQL database and PHP scripts to process data. The computer vision analyzer is developed with PyTorch, TensorFlow, OpenCV and Python.
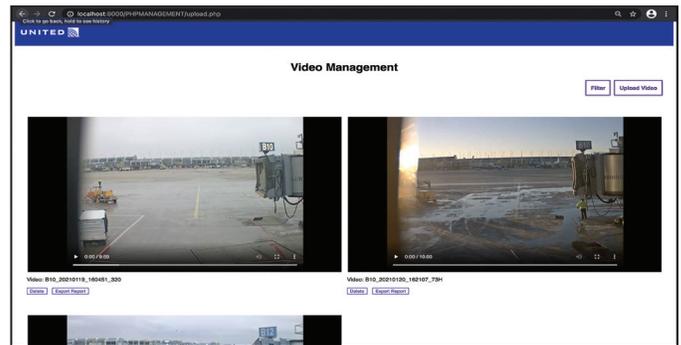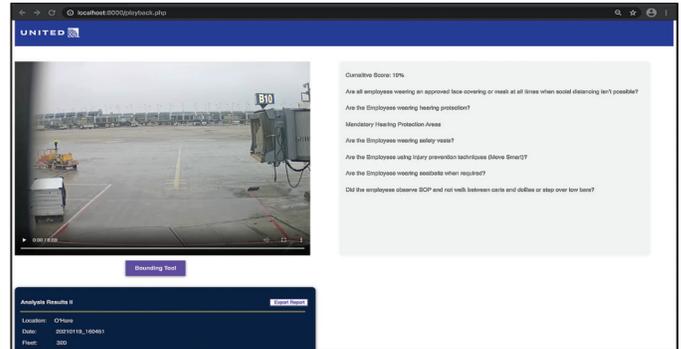
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United Airlines
Training Multimedia Content Management System II

United Airlines is a major international air-carrier headquartered in Chicago, Illinois. In 2019, United Airlines operated 4,900 flights a day from 362 airports. Running an airline requires diligence in all logistical and technical aspects to ensure the best flight experience for "Every customer. Every flight. Every day."

Within United Airlines, the TechOps training division is responsible for teaching United's technicians how to operate and maintain their wide variety of aircrafts. To supply this training, United Airlines currently maintains a vast encyclopedia of training documents and videos.

Our Tech Ops Training Content Management System II builds off a previous capstone project and provides quick access to this training content through an intuitive, easy-to-use website.

Our work expands an already existing website to give United Airlines employees and administrators a better user experience and greater control of their training media needs.

When employees use our system for training, they are given many tools to track and assess their training progress. An engagement report is generated for each user, which includes a collection of their recently viewed content, bookmarked videos, comments and likes.

United Airlines administrators are given improved tools for content upload and management, including options for bulk import and export of training content. Additionally, administrators are given an audit log to track any requested changes.

Our system greatly improves content management, saving employees and administrators significant time and effort.

Our system is optimized for both tablet and desktop use and is built using ASP.NET Core 3.1, Angular 10, Node.js, Entity Framework, and an Azure SQL Database. The web app is hosted on a Microsoft IIS server.
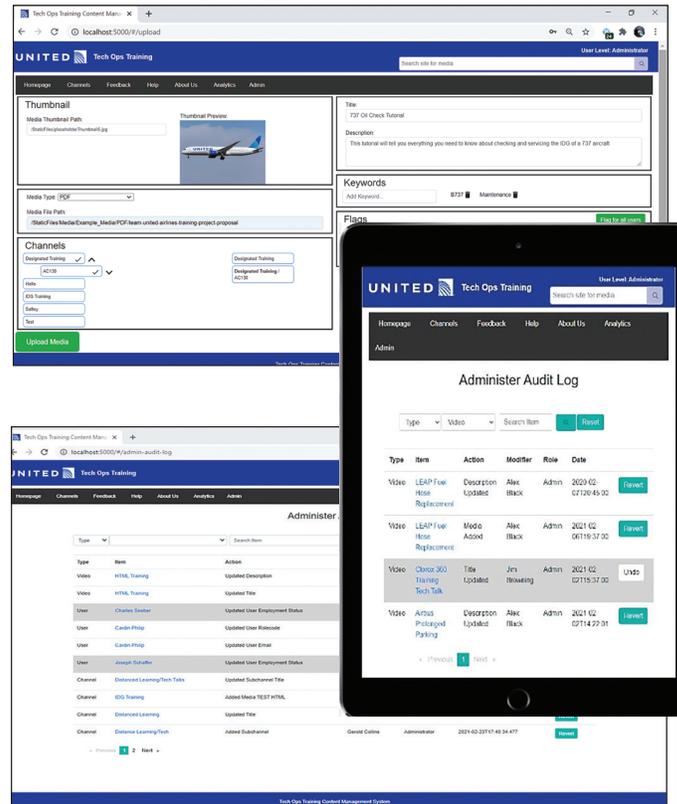
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Urban Science
Service Flash Mobile

Headquartered in Detroit, Urban Science is internationally renowned for providing data-driven, science-based solutions to problems in the automotive industry. With strong industry knowledge, Urban Science provides meaningful solutions for companies from GM to Ferrari.

Currently, dealership field workers, who go from dealership to dealership analyzing data, must set up a work environment to access key metrics in every dealership they visit. This manual process takes time that could be used devising sales strategies.

Our Service Flash Mobile application provides an easily digestible interface for field workers to choose what metrics they would like to view in order to help with sales strategy.

When a user first logs in they are met with a customizable home page. Metrics can be added to the home page by selecting the filters that are desired. The filters range from geography, part type, sold or purchased, and time.

Our software is designed to let users access each metric to view more details about that metric. Details about the metric are broken down further on the metrics page. Depending on the filters applied, users can compare the data selected to either a target goal or the previous year's data. This allows executives at Urban Science to identify areas of opportunity and track progress towards goals quickly, allowing them to act early enough to meet their goals.

Our mobile application allows Urban Science clients to access key metrics intuitively and in a timely manner, which increases communication and productivity in the workplace.

The front end of our application uses Angular, which is a framework that entails HTML, CSS and Typescript, wrapped in Cordova for iOS and Android integration. The back end uses C# and a SQL database hosted on Microsoft Azure. The API is hosted on Microsoft Azure.
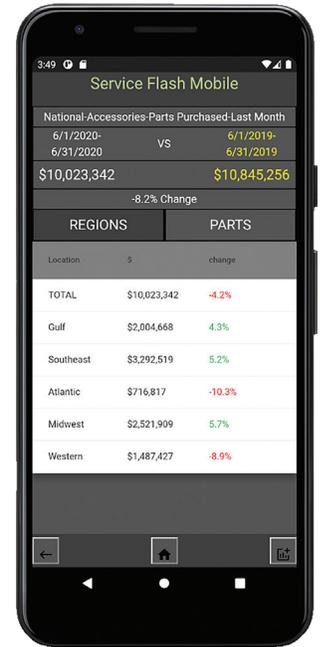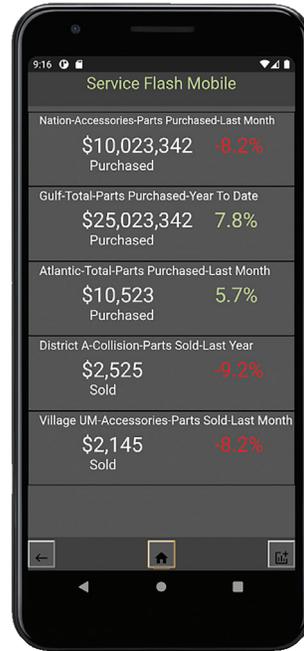
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Vectorform
Remote Teams AR Training

Vectorform was founded in Detroit in 1999 and has provided a platform for many leading brands to solve big problems with inventions emerging at the forefront of technology. They work with a variety of technologies including hardware engineering, Internet of Things, augmented reality and virtual reality in their solutions.

COVID-19 has caused an unprecedented number of employees worldwide to work from home. This has created many problems that need to be solved. One such problem is that of providing interactive learning in a remote environment.

Our Remote Teams AR Training platform helps mitigate these problems with a Microsoft Teams application that gives instructors and students the tools needed to succeed in a remote learning environment.

Our instructor application allows educators to display 3D objects in a Microsoft Teams video stream (shown on the right), and provides a framework to present questions in real time to trainees that are saved for analysis of trainee progress.

When planning a lecture, instructors are given an intuitive interface to select and test various 3D object files on their video feed. Instructors can then present these 3D objects with themselves and other training materials in the background when they hold a live lecture to make their lecture more engaging to the trainees.

Our software also allows instructors to quiz trainees on the topics being discussed, which can then be analyzed to make sure that trainees are learning the material properly.

The 3D object manipulation aspect of our program is implemented as a C# program which interfaces with the camera feed for Microsoft Teams. The quiz portion of our program utilizes JavaScript to make a custom Microsoft Teams module. Both of these sides of the program connect to a SQLite database, which stores the quiz and 3D object information.
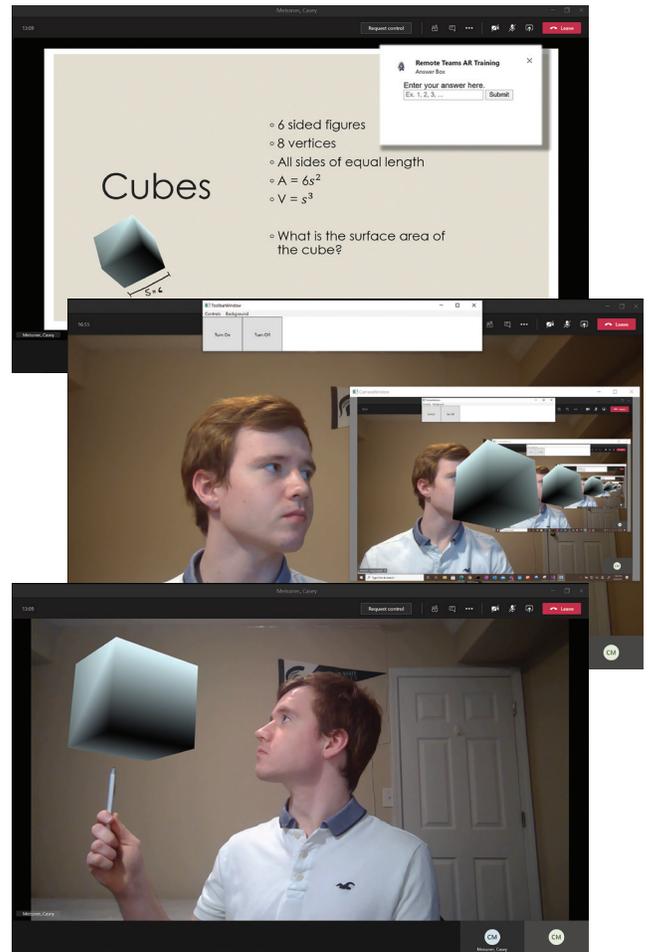
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Team Malleable Minds

Auto-Owners Exposition Award
Team Learning A-Z

MSU Federal Credit Union Praxis Award
Team Bosch

MSU Federal Credit Union Praxis Award
Team Anthropocene Institute

TechSmith Screencast Award
Team United Airlines Training

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Urban Science Sigma Award
Team Volkswagen

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