CSE 120 Project Summaries
Spring 2023

1. Can Damage Detection by Vision

Background

Throughout the year, **Neil Jones Food Company** (NJFC) plants produce a variety of California tomato and Pacific Northwest fruit products for industrial, foodservice and retail customers. Our Northwest Packing facility has been canning Pacific Northwest fruit and providing industrial juices, purees and blends since the 1970s. Our TomaTek facility, built from the ground up in the 1980s, quickly became a leader in aseptic technology supplying fresh-pack California tomatoes in industrial sizes and convenient #10 equivalent pouches. San Benito Foods has been a preeminent packer of fresh, vivid, vine-ripened California tomatoes for over 100 years. Located in Hollister California, our historic 1915 cannery is the ultimate example of what it looks like to produce a high-quality product that will stand the test of time. Because freshness and quality are our primary goals, we work long hours to ensure every product meets not only our strict quality standards, but more importantly – yours.

The customer list at the Neil Jones Food Company is diverse – from the finest independent restaurants in the country, to children's lunch trays across the U.S. We also customize products for food manufacturers, chain restaurants, healthcare facilities, juice manufacturers, and cruise lines around the world. Whether you've known it or not, you've probably enjoyed our fine products in your favorite retail private label brands, or enjoyed them in fine restaurants throughout North America.

Problem(s)

Due to unpredictable and uncontrollable challenges, the can lid placement and sealing process creates a seal problem with the cans. The cans are flipped after the top lid has been placed and the rims rolled to seal the product in. Sometime the lids are placed so far off that there is a large offset in the lid and the top of the can itself. This will cause the product to run out after the cans are flipped over and run along the can lines. Secondly, if the seamer goes out of tune or is not properly set up, it will roll the lid and can lips improperly and will cause the cans to be just slightly taller. This extra height in the cans will cause issues in the next processing equipment.

Currently, we do not have any detection or rejection system to pick up these improperly process cans and remove them from our processing lines.

Objectives

Develop a (vision-based) solution that will detect the dented cans, offset lids, and too tall cans and reject the cans from the process lines.

2. TA Allocation Algorithm Implementation

Background

The client is the **Computer Science & Engineering Department** at UC Merced. Our business is to teach Computer Science, and we are located at the heart of the Central Valley, in the bustling little town of Merced. A major component of effective Computer Science education is practical laboratory sessions, and we rely heavily on Teaching Assistants (TAs) to run those activities.

TAs are selected from the pool of graduate students in our department, but since there may often be more graduate students than the number of TA positions available, this means that not every graduate student is guaranteed a TA position. When this situation arises, it is necessary to allocate the TAs based on a strict set of rules that the department has agreed upon, so that everyone is onboard.

Problem(s)

The department has developed a formula for determining TA eligibility and priority, based on several factors, including experience in TAing courses, evaluations, etc. Applying the formula by hand is an extremely cumbersome, and error prone process, sometimes resulting in unfair allocations.

Automating the process is essential, especially given the growth of the department, in terms of both faculty, as well as graduate and undergraduate students.

Objectives

If a team takes on this project, they are asked to develop a database-driven web application that allows the user to see TA allocation history, current eligibility and priority scores for each graduate student and faculty member, as well as the ability to create an allocation, based on faculty and student preferences.

The application should be accessible via a web interface, with data stored on some server (preferably some SQL flavor). Since the data is sensitive, security would be of utmost importance.

There is currently a prototype application already developed, which can be used as inspiration for the project, but the prototype lacks a lot of necessary features as it is just a proof-of-concept.

If a team takes on this project, more specific details will be provided, especially around the allocation formula, necessary for computing eligibility and priority.

3. Bottling Change Part Wear Measuring Tool - Phase 2

Background

E & J Gallo Winery's bottling facility in Modesto California produces several million cases annually. Most of these cases are produced in glass bottles. These bottles need to be transferred smoothly inside filling, capping, and corking equipment to maintain quality. Typically, plastic change parts are used in this application.

Problem(s)

The plastic used to transfer and position bottles wears over time. As the plastic wears the pocket that these bottles fit into enlarge allowing for unwanted bottle movement. If the pocket becomes too large, quality defects can be introduced on the finished product.

Objectives

Design a tool that can be used to measure the pocket size in a variety of change parts. The goal is to have a tool that is operational with one hand, provides repeatable measurements independent of the person using the tool, and measures down to a high precision. The tool should be designed for 750ml and 1.5L bottles.

4. Planter Revitalization & Modernization App

Background

The **UC Merced Experimental Smart Farm** (ESF) is under development. A part of the ESF's responsibilities is to manage the existing UC Merced Irrigated Pastures. The pastures are irrigated using a century-old irrigation system that delivers water using gravity and valves. Each valve is tied to an irrigation check and the checks are separated by small borders/berms.

Problem(s)

Keeping track of valves is a pain. Currently a Microsoft Form is used to track the start of irrigation activities that feeds an Excel table, but to finish the activities, you have to manually update the Excel table and calculate how many hours it ran.

Objectives

Mobile app for tracking valve on and off times and calculating durations. Integrate with a map interface so you can see which irrigation checks are currently on/off and then be able to select the check to see historical irrigation activity.

5. Using Sensors to Collect Road User Data

Background

The **Merced Bicycle Coalition** (MBC) is a group of bicycle activists looking to make Merced a more bicycle friendly city. We educate community members about bicycle safety and try to convince our local government to implement safe bike infrastructure.

Part of our mission is to promote bicycling and some of our members are on the city bicycle advisory commission to support efforts for bicycle planning. Planning and advising on bicycle infrastructure and problems needs to be backed by road user data, which this project is aimed at. It is a practical research project including research, building, and testing of a specialized bike counting sensor.

Problem(s)

In December 2021 the California Department of Transportation (Caltrans) officially adopted a complete streets policy. This policy states that 'all transportation projects funded or overseen by Caltrans will provide comfortable, convenient, and connected complete streets facilities for people walking, biking, and taking transit or passenger rail' (https://dot.ca.gov/-/media/dot-media/programs/sustainability/documents/dp-37-complete-streets-a11y.pdf). Similarly, the Merced Bicycle and Pedestrian Advisory Commission has recently discussed a potential proliferation of electric skateboards, scooters, and bicycle use. For city planners and contracted engineers to plan a complete street infrastructure, data about frequency and classification of traffic is essential.

Existing solutions of vision-based traffic counters do not automatically classify e-scooters (only pedestrians and bicyclists). The alternative, manually working though visual data, is costly and inefficient, because of the labor is takes to classify. An automated vision-based traffic counter will help facilitate traffic planning by providing the necessary road user classification.

Objectives

Develop a working prototype for a vision-based traffic counter. Write software that analyzes the visual data to automatically count and classify road users (e-scooters, bicycles, and pedestrians).

6. Farm Robotics Challenge - Autonomy/Course Navigation

Background

A consortium of academic and commercial institutions based in California has created the "Farm Robotics Challenge". Quoting the material provided by the organizers, the challenge is "a 3-months robotics development challenge for student teams to develop a novel farm robot to perform and automate an essential farm function on any crop or farm using the Farm-Ng robotics platform". The organizers are lending to **UC Merced** a Farm-Ng platform free of charge (more details about the robot can be found on https://farm-ng.com/). The organizers further specify that, "specific challenges will be pre-identified for teams to choose from, or teams may choose to create additional or custom functionality to solve a self-identified challenge".

Problem(s)

One of the challenge categories identified by the organizers is "Autonomy/Course Navigation". The ability to autonomously navigate through a preassigned path (e.g., via GPS waypoints) is a fundamental competence to enable many other farm relevant tasks. The robot shall be able to safely follow the path, where "safely" here means being able to recognize when veering off-course and either correcting the course or stopping.

Objectives

The team shall develop control software for the robot addressing the specified challenge, as it gets further refined by the organizers. Software will be developed using the API provided by the farm-ng company (ROS -- robot operating system). The robot will be retrofitted with GPS receivers and Inertial Measurement Units (IMUs) to aid the navigation task. For an assigned course to follow, a performance of measure is the percentage that can be completed under different operating scenarios.

7. Farm Robotics Challenge - Artificial Intelligence (Vision and Sensing, Dataset collection)

Background

A consortium of academic and commercial institutions based in California has created the "Farm Robotics Challenge". Quoting the material provided by the organizers, the challenge is "a 3-months robotics development challenge for student teams to develop a novel farm robot to perform and automate an essential farm function on any crop or farm using the Farm-Ng robotics platform". The organizers are lending to **UC Merced** a Farm-Ng platform free of charge (more details about the robot can be found on https://farm-ng.com/). The organizers further specify that, "specific challenges will be pre-identified for teams to choose from, or teams may choose to create additional or custom functionality to solve a self-identified challenge".

Problem(s)

One of the challenge categories identified by the organizers is "Vision and sensing, dataset collection". Autonomous data collection at scale is instrumental to implement precision-ag practices. Robotized data collection includes the ability of identifying relevant areas (e.g., via image processing), approaching the location, and collecting data. At this stage it is anticipated that data collection will be limited to RGB cameras and/or video.

Objectives

The team shall develop control software for the robot addressing the specified challenge, as it gets further refined by the organizers. Software will be developed using the API provided by the farm-ng company (ROS -- robot operating system), as well as libraries such as OpenCV or similar. The robot will be retrofitted with cameras and GPS receivers. A measure of performance is the amount of relevant data collected by the robot.

8. Virtual Warehouse

Background

Nutstar Software LLC is a Merced based software company. We have been building software for the Tree Nut Industry for 15 years. We value our client base and want to continue to innovate technology to further improve the industry and its efficiency.

Problem(s)

We have created virtual warehouse software and technology that will allow for inventory handled without human scanning. While we have engineered an initial product, it has proven to be costly and difficult to implement. We are planning to replace a portion of our technology with Bluetooth and gateway equipment.

Objectives

Request to write a code in C# that tracks the Bluetooth asset tag (AoA – Angle of Arrival -- Beacon/moving device) from an AoA Gateway (Locator/receiver/fixed position) to a grid measured by feet (See reference "Hardware labels" and "4x4 Grid" in https://ucmerced.box.com/s/44n679xfchxbb27aqsj151z1jukmc5af). The dimensions of the grid can be of any length, as long as they are uniform.

Position readings would come from an AoA Beacon to the AoA Locator, to which the data will be extracted and passed on to a PC (Windows 10/11 OS). The data extraction can be in string or int datatypes.

Devices are from Dusun, which has open-source code samples that includes API that can be used for this project.

9. EZFileTrail

Background

Western Digital Corporation (WDC) is an American computer hard disk drive (HDD) and Solid State Drive (SSD) manufacturer and data storage company. Our organization works on designing and delivering product solutions to bring technology to end products. We are located in Milpitas, CA. We are R&D engineers. This project will help us to manage our critical documents more effectively and improve our productivity.

Problem(s)

We have a large number of documents/spec/files from different sources: created by ourselves, shared by our colleagues, and shared by our customers or vendors. They could be located in different places, our PC, box, MS team, SharePoint, and email. It is very challenging to track where are the files and which one is the latest one.

The goal is to design and deliver a web application that allows each user to keep a record of all his/her files and their locations so that they can find them easily in the future. This solution will improve the productivity of all teams. There are no constraints for this project.

Objectives

Develop a Web application with the following:
1. Each user has his/her own account and their data is only be visible to them
2. Key features
   - Add a new record: File name, link to file, label, comments, rev, source, and other information.
   - Edit existing record.
   - Display all records: Sortable by all fields.

- Search from all records: by created date, tag, source, by file name.
- Export all records to Excel.

10. Relevance Weighted Multiple Meeting Scheduler

Background

In the Software Capstone - **Innovate to Grow** (I2G) program we develop multiple modules that shall combine to address problems and user needs while searching and organizing information to create new knowledge. Previous projects included aggregation of data from multiple apps, merging selected results from multiple searches, constructing composite time ranges and geographic areas for a search.

Problem(s)

Available technologies to find meeting times have the following problems that cause meetings to be canceled, postponed to infinity or lacking key participants (these problems are evident in the most popular services such Doodle and When2Meet):
- Assuming that every participant has the same relevance to the meeting.
- Participants can't change their mind about availability.
- Do not consider participation in person versus virtually (which may significantly change the time to join, and therefore the availability).
- Participant slots are unavailable by default, which influences participants to only express their preferred time.

A previous Capstone team developed a first prototype to demonstrate the concepts of a solution, with respect to services like Doodle or When2Meet:
- Participants can express an "availability value" for each time slot.
- Organizer can express a "relevance value" of each participant.
- The calendar displays the weighted availability of each time slot.

The problem can be extended to the creation of multiple meetings with groups of participants. For instance, the Innovate to Grow program's design reviews need to be scheduled for each team with the respective clients and participants. It is hard to find a schedule that accommodates the schedules of students' classes and busy invitees.

Objectives

Build an app that enables entering availabilities and relevances of groups and see in real time the variations for group scheduling to inform the optimal final schedule.
Organizer:
- Define time slots on a calendar (matrix of slots) for one or more meetings.
- List of participants: to one meeting, or to groups and respective meetings.
- For each participant in a group/meeting, express a "relevance value" for that group/meeting.
- For each participant also express the requirement: in person, virtual, or either.
- Define whether the participants shall start as totally available (participants have to turn off unavailable slots) or unavailable (participants turn on available slots).
- View whether participants responded or not.
- View the result for each time slot, the weighted group availability (number + color).
- View real time changes with variations of availabilities and relevances.
Participants:
- See the respective matrix with the following starting options in all time slots: black (not considered for meeting) – green (available) - red (unavailable).
- Can change each slot, expressing the "availability value" (e.g., in the range red=0.0 to green=10.0).
- Can modify the availability of each slot or groups of slots viewing the matrix change in real time (number - color).
- "Commit" their availability when ready.
Requirements - in order of importance:
- Find a color palette that provides a good user experience to represent availability, relevance, and the resulting relevance weighted group availabilities.
- The change in availability (participant) or relevance (organizer) must change the colors/values of the respective slots in the matrix in *real time*.

- Deployment on a web server, so that the choices and user experience of the organizer and multiple participants are visible in real time.
- Organizer can add participants – groups.
- Participants can change and recommit their availability.
- Integration of the above features with other common calendar features.

11. GUI for an Image Recognition and Classification Open-Source Software

Background
Western Digital Corporation (WDC) is an American computer hard disk drive (HDD) and Solid State Drive (SSD) manufacturer and data storage company. The Flash SSD engineering department is located in Milpitas, California. We design, develop and test world class flash memory products.

Problem(s)
3D NAND has many memory holes. The shape of these memory holes determines the property of the memory cells. We use the open-source AI/ML software to identify the quality of the memory holes and classify it. Engineers would like to have an easy GUI interface to make the software usage and parameter tweaking more user friendly.

Objectives
Build a GUI interface in Linux environment to help to enter parameters to adjust the AI/ML models to fit our needs. Additional details can be found at https://ucmerced.box.com/s/c2smom9uimk6kz5g77uiokce7hrihy6n.

12. Inventory and Condition of Vegetable Seedlings in Trays - Phase 2

Background
California Transplants is a nursery that produces vegetable seedlings for professional growers throughout California. Located in Newman, CA and primarily known for growing tomato seedlings, we now are producing many different species of plants for growers the entire year. This project falls under software and hardware.

Problem(s)
We currently manually count germination rates or usable plants per order as a percentage. That data then is entered into our system manually which gives us the best estimate of our inventory per order. We are looking for a system that could scan the greenhouse and count the number of viable plants per order and produce a report. We are looking for technology to help us get an accurate inventory report to determine needs or changes downstream.

Objectives
Develop software that will work with a series of cameras that can accurately count the number of usable plants per order. There can be multiple orders in a greenhouse. The objective of phase 2 is to:
- Identify trays, and cells within trays.
- Determine for each tray cell the status of the plant seedling (good, bad, multiple, no plant).
- Prepare the user interface to view and the data.

13. Assessing and Grading Wood Bin Parts

Background
In 1970, Chris Rufer began **Morning Star** as a one-truck owner-operator company in California's Central Valley, hauling tomatoes from fields to canneries. Today, Morning Star operates three factories with the largest production scale in the world, with resources solely dedicated to tomatoes. We supply over 40 percent of national markets with ingredient tomato paste and diced tomatoes. We provide bulk-ingredient products to food manufacturers and pouch and can ingredient and finished products to the food service and retail trade. We are actively involved in the global tomato industry and ongoing tomato research, and we have pioneered changes in production technology that have helped increase efficiencies throughout the industry. Our sales of tomato products are over $800 million annually. And we still haul our tomatoes from the fields – just as our owner began his journey in 1970. Our mission is, and has

always been, to produce tomato products which consistently achieve the quality and service expectations of our customers in a cost-effective, environmentally responsible manner.

We have two processing plants near Los Banos, and a third in Williams, CA, in addition to a Tomato-Drying Yard in Newman and Greenhouse Operation near Tracy. In our processing facilities we convert fresh, ripened tomatoes into shelf-stable tomato ingredients such as paste and diced, packaged in Aseptic bags within 50-gallon drums and 300-gallon bins (wood / plastic / or metal). The largest secondary (outer) container is the wood bin which collapses into 6 subcomponents. This packaging configuration is environmentally friendly and cost effective as it is returned by the customer and reused for 8 or more cycles. Customers return bin parts to us year-round and we operate the bin sort and repair operations accordingly.

Problem(s)

Morning Star Bin Sort and Repair colleagues perform a visual / tactile inspection of millions of bin parts between our 3 plants to grade parts based on whether they are good, repairable, or destroy / salvage. For repairable items they also identify what needs to be done to remediate the part to ensure it becomes a good, usable part. We spend millions of dollars annually to replace the small fraction of bin parts that are graded as unusable. Making consistently good decisions in the grading process can avoid unnecessarily discarding usable components, while ensuring that approved parts will consistently perform their required duty cycle without failure and product loss. If an automated vision system could be used to make more consistent, good decisions in this grading process, the average life cycle of bin parts could be increased, which has a significant economic and environmental benefit. The system would need to be capable of being successfully taught what constitutes good / repair / destroy components.

Reasonable and prudent capital / equipment costs beyond the default project budget can be negotiated to enhance project success.

Objectives

The primary success factor is whether the vision system can be successfully taught to discern mechanically usable components from a diverse range of part appearances (older / newer components), with one or more part types (the six sides are comprised of 4 different part types with a couple of variations). The year-round nature of our bin sort operation would afford a motivated team the opportunity to tweak and optimize the algorithms to enhance performance. In addition to the core functionality, some of the bonus features that would enhance value would include:

- A functional system that can operate in-line with current sort processes and provide near-real time feedback and recommendations on the grading status (and would make it easier to populate the "teaching" library).
- Identifying the defect mode and / or the required repair.
- Keeping track of a parts count of each status.
- Picture retention of parts processed for future review, particularly in cases where the algorithm disagrees with the sorting colleague (useful for training and gaining agreement / training on "borderline" parts).

14. Connected Construction

Background

Telit Cinterion Lend Lease (TC) is a rapidly growing General Construction Contractor operating in the Southwestern United States. The company manages large scale commercial construction projects including hi-rise office buildings, retail and entertainment centers and sports arenas.

Problem(s)

The client's growth is currently constrained by two factors: project execution delays and the loss of tools and materials on the jobsite. These factors are harming the business' reputation and bottom line. Whatever solution is adopted must be simple to deploy, easy to use, and built to scale. It must be able to work within the existing environment.

Objectives

Create a construction project visualization dashboard and companion mobile app that provides location and condition data for multiple jobsite assets (tools, equipment, materials). The visualization must allow for toggle between macro and micro site views with drill down options. Sensor accuracy, user-defined geo-fence and alert notification, and ease of navigation are all highly valued by the client.

15. Real-Time Optimization of Mobile Robot Deceleration Profile

Background
Omron Robotics and Safety Technologies (ORT) is an automation technology development company focused on robotics design and manufacturing. Omron is the leader in the field of industrial automation with operations in over 40 countries and 150 locations worldwide. Our company is unique in that it develops new electronics, mechanics and software for an exceptionally broad spectrum of robots – including SCARA, articulated, parallel link, cobots, and autonomous mobile robots – for the global market. This project will support Omron's mobile robot product lines.

Problem(s)
Omron makes stock mobile robots with a well-tuned deceleration profile. However, our customers may load the stock mobile robots with different weights and varying speeds as they approach their destinations. The result is reduced positional accuracy. By applying an artificial intelligence/machine learning approach to optimize how the robot slows down before stopping, students can improve the performance of our robots.

Objectives
The aim of this project is to train a neural network that will dictate the deceleration of a robot to execute smooth and precise stopping. We do not know the weight loaded on the robot nor the floor conditions, as some floors might be slippery. The system will change commanded deceleration value based on a difference between commanded and executed deceleration in the previous cycle. We assume that at any time, we know the perfect distance between a robot and a goal, and we can also measure executed deceleration perfectly. Students will use the reinforcement learning approach to train the network and overcome combined issues that stem from noise in the system, not knowing the mass of the payload and surface quality of the floor.
1. Students will develop a simple physics engine.
2. Students will develop a reward function that incorporates deceleration smoothness and final position precision.
3. They will train a neural network and demonstrate the progression of accuracy over the number of training iterations. Finally, they will compare the final results to the vanilla straight-line deceleration method.

16. CTTA Member Database Management and Automation

Background
Founded in 1969, the **California Tow Truck Association** (CTTA) represents professional towing operators statewide. Created by and for towing company owners, CTTA provides unparalleled solutions and resources that empower towing companies to be more professional and progressive within the industry while serving the motoring public. The mission of the California Tow Truck Association is to cultivate a community of professionals able to provide the highest caliber of towing and emergency road service-related solutions for the motoring public and the communities of our state.

Problem(s)
Currently, our current database system does not function appropriately to manage members, and data entered does not transfer to other of our systems. Data is lost and membership renewals and communications get lost.

Objectives
The objective is to consolidate systems and have one central database that can host and manage members, member renewals, and member communication all in one system that can be on our website.

17. Smart Rodent Detection - Phase 2

Background
Agrecom is a biosecurity solutions company founded in 1995. Initially focused on service and sales into the poultry industry, it now provides a spectrum of solutions in the areas of water treatment and sanitation, targeting clients in agriculture, residential, and commercial sectors.

Problem(s)
When a client reports a rodent issue at a facility, it is the job of the Agrecom's inspection team to determine how bad the problem is. Agrecom has utilized game cameras in the past, but this relies on manual review and counting of the

images captured. Agrecom partnered with UC Merced in the Fall of 2022 to develop an automated classification tool based on Amazon's Machine Learning engine Rekognition so that once the game cameras are retrieved they can be processed quickly.

Objectives

The goal of this project is to build on the work completed by the previous team:
1. To improve the image recognition algorithm to estimate species and age of the rodents detected.
2. Be able to create a map of the location of the camera deployments and create heatmaps and activity views over time.
3. Be able to accept uploads of images to process in the cloud.
4. (Stretch) Be able to automatically upload from a camera device.

18. Flood and Hydrology Alert and Monitoring System

Background

Agrecom is a biosecurity solutions company founded in 1995. Initially focused on service and sales into the poultry industry, it now provides a spectrum of solutions in the areas of water treatment and sanitation, targeting clients in agriculture, residential, and commercial sectors.

Problem(s)

Merced recently experienced the highest levels of flooding in recorded history. During these unprecedented times, there was a lot of different data from various agencies posting in different sites (Army Corp of Engineers, NOAA, Merced Irrigation District, Merced County, Weather.gov, City / County GIS). It was up to the residents of the county to find, digest and process this – and this created a situation where there was a lot of bad information or conclusions being drawn causing panic – or even lack of concern for the serious situation. The county and cities were communicating by social media, which does not necessary working to communicate with everyone.

Objectives
1. Create a web site that takes the publicly available information about creek and river levels and forecasts, dam status and fill forecasts as well as current weather and consolidate this into an easy to use site that can show multiple data points. Adding and removing data points should be fairly easy from an administrative perspective.
2. Create an alert system that given the certain criteria (creek level, dam level) can create an electronic alarm when a threshold is breached to be communicated automatically using social media, text or email. Users can then subscribe to these alerts.
3. (Stretch goal) Using GIS data, flood plain and maps, create a projection of impacts of levee riverbank or breaches using street data from around the county.

19. Cilantro Yield Estimation

Background

SupHerb Farms is a company located in Turlock, CA; whose primary business is contracting culinary herb production, processing of those herbs, and sales of finished products around the world. The primary herbs produced by SupHerb Farms are Basil, Cilantro and Parsley.

Problem(s)

SupHerb Farms would like to be able to accurately determine harvestable pounds of herbs from each production field prior to harvest. Herb crops grow every day and maintaining a schedule is difficult for SupHerb as we visually estimate fields and often make errors in our estimation. These errors either cause plant downtime due to lack of crop or they cause collisions in between different fields that produce more pounds than were estimated, these occurrences cause product quality issues and potentially plant equipment downtime because we try to push processing machinery above its intended productivity.

Objectives

Experiment will be executed at the UC Merced Experimental Farm Greenhouse in collaboration with SupHerb Farms. The capstone software team's objective is to develop a vision / learning system to detect cilantro leaves, and estimate volume of leaves in an area planted with cilantro, by taking images every day as the cilantro grows. The

weight is calculated after every mow. The first phase of this project is to utilize cameras to see if they can provide accurate measurements of the crop mass of cilantro in the area that is photographed. Herbs are grown primarily for their leaves and the focus of this work should be to identify the total pounds of plant material that would be harvested from the area but to also identify the weight of unusable stems and the weight of usable leaves.

20. Student Experience Navigation

Background
Students at universities must navigate multiple websites containing specific information about the overall student experience. This piecemeal information gathering is time-consuming, disconnected from context, and fragmented understanding. **Globidea** is an initiative of academics that are sharing the objective of making information easier to find and navigate.

Problem(s)
Gathering specific information across distributed websites related to the phases in a student journey, and presenting them formatted appropriately on a centralized website is a manual process that is very time consuming. The problem is that if information is modified in the original source, the centralized page remains outdated. One way to help is to create a link aggregation page: in this case the students have to follow each link and dig to find relevant information in there. The solution for editors would be to select specific information across these linked sources and curate them, while keeping them connected to and updated from the original source. In addition, editors should be able to tag specific information on various pages as they were being developed so that it could automatically be brought to the aggregated site rather than requiring individuals to locate and then capture this information.

Objectives
The goal is to have information related to 5 phases of the student experience be shown on a centralized site, connected to the original content on the other site, always be updated if changes occur, and then gather additional resources and information if new information is tagged on other sites related to a phase. Those phases are: Planning to Attend, Getting Started, Making Progress, Finishing Up, and Moving Forward.

Specifically, we would like a software that allows to copy snippets of information from different pages / sites, pasting them into a curated web page, so that the pasted content links back to the original source. The system would also check if content that was copied / linked into the curated page has changed, and would auto-update the curated page, and/or alert of the change. As a bonus, the software would allow the curator to edit the formatting of the aggregated content.

21. Training Matrix - Phase 2

Background
Betts Company is a sixth-generation family-owned manufacturer and supplier of springs and heavy-duty truck parts located in Fresno, CA. In order to ensure a safe and productive work environment the company needs to ensure all employees are properly trained for the tasks they are assigned.

Problem(s)
Betts Company would like to see a software solution created to collect, warehouse and perform data analytics for the training required throughout the organization. Today the ability of the organization to understand the training of each individual is difficult to manage. The information is collected, but it is difficult to sort out who is trained, what skill level they possess, and when training needs to reoccur.

Objectives
Expand the functionality of the Training Matrix program developed by UC Merced students during the 2022 school year. How: Use the existing program platform as the starting point. Ruby on Rails and SQL will be the primary tools. Goals: Improved user interface, UI functionality on mobile devices, Additional SQL tables, Report Generation capabilities, Scheduling and Reminders, Security features (MS Single sign-on), Deployment to Share Point Environment.

22. Evaluation of Coordination Using VR Hand Controllers

Background

Valley Children's Hospital (VCH) is a healthcare institution located in the central valley of California. VCH provides excellent healthcare service to all the children in the central valley. This project will focus in the Neurological examination using virtual reality.

Problem(s)

There is a need for improving the accuracy of the neurological exam. In order to enhance virtual medicine services (telemedicine, remote services) this project will explore the use of Virtual Reality (VR) to track movement during neurological examinations.

Objectives

Task: Analyze movements of the arm with hand controllers.

Goal: Obtain precisely quantifiable data that can inform our understanding of the arm movements - motion (using the VR hand controller).