CSE 120 Project Summaries
Fall 2023

1. Identification of Pathogens in Image Library

Background
Sunburst Agribiotech Solutions, LLC (SAS) is located at Turlock, CA. We do plant/soil/water diagnostics for diseases caused by agronomically important plant pathogens. The specific activity will be using AI in identifying plant pathogens from microscopic images.

Problem(s)
To identify plant pathogens in a non-subjective manner using software that is backed up by AI using the real images of the pathogen as seen under the microscope.

Objectives
Use the pathogen images files and create an algorithm and a software program that can now be used to ID plant pathogens.

2. Capstone Purchasing App

Background
The **School of Engineering (SoE) Instructional Lab Services at UC Merced** provides support to Capstone students in terms of providing training and access to instructional equipment, specialized lab spaces, and handling Capstone purchasing requests.

Problem(s)
The problem is to streamline the purchasing process for capstone teams which involves 1) submission of purchase requests by capstone teams to the teaching faculty 2) review and approval of the purchase requests by teaching faculty 3) tracking team budget/expenses for faculty to consider during the approval and 4) submission of the approved purchase requests to SoE Instructional Staff.

Objectives
The objective of the project is to develop an APP to streamline the capstone purchasing process to get timely approval from the faculty and reduce the staff time. Complete capstone purchasing process involves:
1) Purchase request submission, approval, budget tracking, maintaining inventory of purchases.
2) Placing the order using CBS2/Oracle system.
3) Getting tracking/delivery updates to the Campus
4) Delivering the items to various teams

Minimum viable product should include the following items:
1) Submission of purchase requests by capstone teams to the teaching faculty: SoE Staff will provide a sample purchase request form along with data verification criteria for various fields. Once the form is submitted by a Team, teaching faculty should be notified of the submission.
2) Tracking team budget/expenses for faculty to consider during the approval: Team's expenses should be tracked against the allotted budget for each team. This information should be available to the teaching faculty with each purchase request submission.
3) Review and approval of the purchase requests by teaching faculty: Reminders should be sent to the faculty until the approval process has been completed. If the request has been rejected, the reason for the rejection should be communicated back to the team along with suggestions from the faculty.
4) Submission of the approved purchase requests to SoE Instructional Staff: If the request has been approved, the approved purchase request form should be submitted to SoE staff for processing.
5) A running inventory of all the approved items should be available for SoE staff and teaching faculty to keep track of purchases and flag items for retrieval at the end of the semester.

Add-ons:
1) Placing the order using CBS2/Oracle system: This will require communication between APP and Oracle API (involves campus level permissions).
2) Getting tracking/delivery updates to the Campus: This will require getting relevant information using Oracle API based on the Purchase Order number.
3) Delivering the items to various teams: This will require identifying the delivery boxes by scanning labels. Once the team is identified, a custom message is sent to the team regarding the delivery place and time.
4) Making instructional equipment requests: The App should provide a way for student teams to make equipment requests to the Instructional Team. The request should first be approved by the instructor before being routed to the Instructional team (email will be provided).
5) Making lab access requests: The App should provide a way for student teams to make lab space requests to Instructional Team. The request should first be approved by the instructor before being routed to the Instructional team (email will be provided).
6) Safety training report: The App should allow the instructor to upload student roster along with team information (team numbers, team members, roles). Each student should be able to upload their safety certificates to the app. The App should be able to generate a report indicating which students have completed the training and which are still pending.

3. Employee Coaching and Development Tracking Page

Background
As the preferred leader in temperature-controlled warehousing and logistics services, **United States Cold Storage (USCS)** offers highly reliable, cost-effective, and environmentally sustainable solutions for the frozen and refrigerated food industries. Our approach is to build high-quality warehouses equipped with the newest, most efficient refrigeration technology available and engage strong local management teams who continuously measure and improve performance.

USCS manages more than 376 million cubic feet of temperature-controlled warehouse, and distribution space in 42 facilities located across the United States. USCS is the third largest public refrigerated warehousing (PRW) logistics provider in North America and employs more than 3,500 service professionals. USCS also offers logistics and transportation services. Our consolidation programs are the best in the U.S. - building full trucks from less than truckload (LTL) shipments and helping our customers be more efficient. We have nationwide coverage and a flexible distribution model that fits many business needs. Goods get to the market efficiently, consistently, and most importantly - safely.

Our transportation management system (TMS interfaces with all USCS operating systems to access customer order information, deliver electronic data interchange (EDI) transactions sets and update reporting needs for every stage of the transportation management process.

Problem(s)
The current observations page on Performance Plus (USCS Labor Management System) is designed and aligned with an older process of performing coaching and observations. Over the last 6 years, with changes in customers and processes, there have been massive changes in observations and coaching processes. This demands a revamp of the observation page in Performance Plus that assists the new coaching processes and efficient tracking.

Objectives
Provide a better and efficient coaching and observation tracker webpage to eliminate the need for manually tracking follow-ups. This will be relevant to the new coaching process. This will give ability for the company to sustain the new coaching process and utilize it to make LMS proficient and promote a productive work environment.

Standard Features:
• Different display pages based on type of coaching (skill and behavioral).
• Drop down option for task type, date user, observer. Check marks for list of skills to select.
• Date dropdown for follow-up date.
• Display interactive KTS (training documentation) with check marks.
• As each check mark gets selected, it gets quantified (score) based on skills, behavior, and safety.
• Option to attach any documents.
• Ability to link original (parent) observation if this is a follow-up using observation ID no.

- Once it is linked, the page should show the history from the previous one.

Bonus Features:
- Provide analytics on based KTS score, performance correlation.
- Show trends from previous parent observations along the follow-up ones.
- SMS or email as reminder of the follow-up.

4. Data Clean-up Tool

Background

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Problem(s)

The presence of large amounts of bad data which does not comply with the required format, currently not relevant and that has been entered into the warehouse management system (WMS) incorrectly and cannot be utilized for any purpose. This data always causes hinderance in many daily activities, become hurdles when the company transitions to a new WMS and most importantly occupies huge amounts of memory in the server systems. A tool which can help identify this bad data, modify it to required format and delete gaps, if necessary, can help resolve many of the forementioned issues.

Objectives

Objective is to design and function tool that can help the company to identify and delete, modify, fix this bad data, gaps in data, and eliminate a large amount as per user requirement. This will reduce manual work related to fixing this bad data.

Standard features:
- Ability to read various formats of data (xml, csv, pdf etc.;) and display in rows and columns.
- Give the user the ability to define each row or column of data according to the user's preference. And modify or display the data that is not according to the defined parameters. Preferably in GUI for a layman to use it.
- Combine different sets of data of same format into one set and customize as per user requirements.
- Ability to export into different formats as per user needs.

Bonus features:
- Identify duplicate data in different formats, errors such as wrong address format, punctuation, spellings, and address styles. Filter the data and display the rows and columns with these discrepancies.
- Creating visuals from the data.

5. Camera to Robot Calibration

Background

Omron Robotics and Safety Technologies, Inc. (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 robotics - including Selective Compliance Articulated Robot Arm (SCARA), articulated, parallel link, cobots, and autonomous mobile robots - for the global market.

Problem(s)

ORT designs and manufactures, among other things, non-mobile Robots, or Robotic 'arms'. They are configured to run with a PC controller that can also drive cameras and part moving equipment such as part feeders and conveyor belts. The software that configures and runs on the PC and robot is called ACE (Automation Control Environment).

These robotic arms can be used to move pieces from one part line to a different place (pick and place). To enable seamless object detection and precise robot positioning, the ACE software relies on camera-to-robot calibration. This process involves converting camera coordinate positions into the robot's own X-Y-Z coordinate system.

ACE software system has the ability to locate objects in the real world using either 2D or 3D cameras. In some instances, the camera can be mounted to a part of the Robot's arm.

ACE requires the ability to obtain a robot coordinate position from a position located in any newly obtained image or point-cloud (Camera coordinate system). This ability is referred to as camera to robot calibration. The calibration procedure happens through a series of pictures from a given camera position and interactive robot arm tip real world placements. A real world "calibration object" (3D printed piece) is in some cases placed in the images them and is easily recognized by ACE. The user moves the robot to touch the tip of the object. There are slightly different calibration methods in use currently depending on if the camera is arm mounted, etc.

Currently, there are some shortcomings to the process. Calibration may need to be redone several times until a reasonable accuracy is achieved. The user input is critical, and errors are easily introduced. A lot of positioning is involved, and the right positions must be chosen.

A single robot to world 3D translation is generated from the procedure. The precision of a given translation conversion may be off by several mm.

Objectives

We would like to improve the accuracy of the robot positions estimated from the camera by replacing the calibration method that does the conversion and/or the process to obtain it.

The UC Merced team is embarking on an exciting opportunity to revolutionize the field of robotics by enhancing camera-to-robot calibration for Omron's Industrial Fixed Position Robots, powered by the cutting-edge ACE software. We are seeking passionate and innovative students to collaborate with us in developing groundbreaking algorithms and C# .dll files that will redefine the precision of robot positions estimated from camera inputs.

By joining our team, you will have the chance to explore advanced techniques for calibrating camera vision coordinates to robot coordinates, working with both 2D and 3D images/point clouds. This is a unique opportunity to dive into the fascinating world of robotics, combining computer vision and automation to create real-world impact.

Throughout this collaborative project, you will work closely with industry experts from the ACE team, gaining invaluable insights into the state-of-the-art technologies used in industrial robotics. Your contributions will be instrumental in pushing the boundaries of calibration accuracy, revolutionizing the way robots perceive and interact with their environment.

Not only will you have the chance to pioneer innovative solutions, but your work will also be evaluated for its precision and usability. We aim to develop a calibration method that is not only highly accurate but also user-friendly, ensuring seamless integration within the ACE software ecosystem.

6. WDTrainTrack

Background

The client is **Western Digital Corporation (WDC)**. Western Digital Corporation is an American computer hard disk drive manufacturer and data storage company that provides cost-effective solutions for storing, generating, and accessing data. It designs, manufactures, and sells data technology products, including storage devices, data center systems, and cloud storage services. The client for this project is R&D global teams, located in different countries. This project focuses on training management.

Problem(s)

The limitations of current manual, labor-intensive training management methods result in suboptimal learning outcomes and inefficient use of resources. Commercial solutions often fall short due to lack of customization options and adaptability to specific organizational needs. Our proposed application provides a tailored solution that boosts the

efficiency and effectiveness of training, ultimately impacting overall organizational performance. By automating and digitizing training processes, we empower managers to devise custom training plans, automatically track progress, and provide real-time updates, enabling quicker decision-making and resource allocation.

Objectives

The primary deliverable will be the fully functioning web-based application. This includes:

- User Interface (UI): A user-friendly, intuitive, and responsive web interface for employees, managers, and administrators.
- Backend Server: A secure and efficient server setup to handle requests and provide services such as user management, progress tracking, and notification management.
- Database: A well-structured database to store all relevant data.

7. DocGPT

Background

Sweep designs big data workflow software that is used for processing different types of data such as images, text and machine data. Using the Sweep API, a simple cloud-based data gathering platform for storing and analyzing time series data in a scalable fashion, we work with customers to provide custom workflow solutions. Large Language Models have the potential to change the landscape of what it means to be a knowledge worker and revolutionize the way we collect, analyze, and understand data.

Problem(s)

Company knowledge is often times available only through PDFs within an internal internet. In many cases, when too many PDFs exist, information can become lost due to the sheer volume of documents created by the company on a regular basis. We would like to develop a simple tool that will allow us to read the contents of a PDF and create machine readable text that summarizes the information in the document for further processing in a custom workflow. Using a readily available open-source large language model or online API, you will develop a software tool that will interact with either local PDF documents in a shared network filesystem or within a local web intranet.

Objectives

Develop a JSON schema that summarizes the contents of the PDF using a large language model. For example, if presented with a table on a page, attempt to transform that table into a JSON formatted table object. JSON Schema can be predefined by the team. This includes defining what summary questions will need to be asked to complete an analysis of a PDF. Software workflow must be able to process at least 10 PDFs per minute. Must be able to query compiled PDF JSON data through a REST API. You're able to use either a locally hosted large language model or an online API to generate the machine-readable JSON data.

8. Satellite Imagery Web Application

Background

The Morning Star Company's subsidiary company, **Gradient Crop Yield Solutions (Gradient)**, provides technical services to tomato, pistachio, and almond growers primarily in the California Central Valley. One of these services is crop health images. Previously, Gradient would provide crop health images to growers using drones. Unfortunately, as the number of acres Gradient covered grew, the expense in imaging increased exponentially as well. As a result, Gradient moved to using satellite imagery to provide crop health images to growers. Even though the imaging cost was reduced by switching to satellite images, Gradient is looking to further reduce the cost by creating its own platform to process and view images.

Problem(s)

Currently, Gradient is hiring a third-party company, EOS, to download the dataset of the most recent publicly available satellite imagery from Sentinel 2. EOS then uses a Keyhole Markup Language (KML) file, containing latitude and longitude coordinates, submitted by Gradient to find the grower fields in the satellite imagery data. Afterwards, EOS processes the images using band wavelength manipulation to create the popular crop health monitoring algorithms such as NDVI and NDRE. After the images are processed, they are displayed on a web platform for our growers to view the images.

Objectives
Gradient Crop Yield Solutions is interested in creating a web platform that displays processed NDVI/NDRE images using Sentinel 2 images. Grower fields will be mapped using a list of coordinates stored as a KML file. The ideal design would be a web platform that accepts a KML file and returns the most recent processed Sentinel 2 satellite image using the NDVI or NDRE algorithm. The web platform needs to have a front-end and back-end that interact with each other. The front-end should have an option to upload KML files, while the back end will process the file to get the most recent Sentinel 2 image. After processing, the front-end should render a map with the most recent satellite image overlayed on top of the map.

9. Bio-Secure Scheduler

Background
Agrecom provides a spectrum of solutions in the areas of water treatment and sanitation, targeting clients in agriculture, residential, and commercial sectors. However, this project is being sponsored by Agrecom as a community service. As a sponsor Agrecom has already communicated with county officials about this project and will facilitate introductions to all the necessary public agencies.

Problem(s)
The majority of our customers have stringent biosecurity controls on the technician's ability to visit their site, and then go to another site. Scheduling is manual, and time consuming. We have tried commercial solutions, but none can manage the customer biosecurity restrictions, and the schedule has to be manually redone anyway.

Objectives
Objectives of this project are as follows:
- Taking in a list of technicians, their capabilities, and customers and their job requests, create a weekly/monthly work schedule that strictly follows biosecurity quarantine requirements.
- Taking into account expected job duration, suggest route optimization for each technician maximizing their day.
- Allow the addition of jobs to the schedule and suggest which technicians are quarantined enough to do the work, and what jobs could be impacted by it – shuffling the work and schedule as needed to fit it in.

10. PhoenixSync: Remote Firmware Management for IoT

Background
TC IoT Solutions is the Original Design Manufacturer (ODM) Services and Custom Device Lifecycle Management engine of **Telit Cinterion**, the Western leader in secure global digital transformation and Industrial IoT. The company's secure-by-design products and services enable business operating in Security and Surveillance, Energy and Utilities, Telematics and Tracking, Healthcare and Wellness, and Mobile Broadband.

Problem(s)
The IoT Solutions Business Unit is currently constrained by manual management of firmware-over-the-air (FOTA) updates to customer IoT devices deployed in the field. These factors are limiting the business' opportunities to service new customers and 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
The PhoenixSync Project Team will be tasked with the creation of a robust and user-friendly web-based application to track devices and seamlessly manage FOTA updates. The application and visualization dashboard will offer a comprehensive set of features to streamline the firmware update process, enhance security, and provide valuable insights into device performance.

11. 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 to be 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.

12. Defect Detection on Silicon Wafer Using Neural Network

Background

Western Digital Corporation (WDC) is an American computer drive manufacturer and data storage company, headquartered in San Jose, California. It designs, manufactures, and sells data technology products, including hard drives and Flash Memory Solid State drives (SSD). SSD has been widely used in data centers, cell phones etc. Western Digital is one of the world's 5 manufacturers of Flash memory. The Flash memory is silicon based nonvolatile storage which was manufactured in Japan. Our Milpitas, CA facility is engaged in advanced technology development of flash memory development and manufacture.

Problem(s)

When the silicon wafer is manufactured, there are thousands of different steps, such as etch and deposition, polishing etc. Every step has very sophisticated machines in high grade clean room. But still many defects will be created because of dust or residues of chemical materials. Each defect will eventually result in electrical malfunction in the final products. Therefore, it is very critical to detect the defects in every step of the process steps, instead of waiting until the wafer processing completion many months later. But some defects are very hard to be detected by human eyes due to the faint nature of the optical image. This project is using advanced neural network model to make a delta image by diff the defected image versus defect-less image.

Objectives

The students will be asked to use open-source Regional Convolutional Neural Network (R-CNN) based deep learning to do image data processing. The main purpose is to identify very faint defects in the silicon wafer image. In order to enhance the defect image, a diff image has to be made in comparison to a perfect wafer image. The project has three parts:

1. Generate 'fake' grayscale wafer images for training data: Currently, we use the real clean wafer image for this purpose, but it can be done computationally, and it will help to generalize our final model. This will be the minimum goal.
2. Add random defects and generate training labels for step 1.
3. Train a U-net model to denoise the image. Again, we can add flexibility depending on the skill level. Students can write it from scratch or revise an open-source code. We will give the specification for the final outcome.

13. Digital AI Backpack - Backpack Opportunities Crawler

Background

Students will work on a project that involves two companies: **Conectado** and **Linker Finance**.

Conectado is a venture revolutionizing approaches to Latino inclusion in STEAM, emphasizing technology. We are committed to empowering Latinos to succeed by building safer, simpler, and more sustainable connections from the classroom to career to the boardroom. Conectado is a virtual platform that brings together educational institutions, social impact organizations, and private and public businesses, all working together to increase the representation of Latinos in tech. At Conectado, users can access boot camps and certifications that will allow them to reskill or upskill, connect with educational institutions and potential employers, develop a strategic network, meet mentors, and access career readiness resources.

Linker Finance is an embedded finance platform that expedites the launch of modern FinTech and Bank-like Mobile and Web apps & services within weeks. The platform offers front-end Turnkey solutions, Front-End SDKs, and middleware with over 30+ integrations for card issuing, deposits, bank connection, ID verification (KYC), business verification (KYB), automatic money movement, financial insights, analytics, CRM, and more. We empower companies to unlock additional revenue streams and essential financial insights, enabling them to deliver exceptionally tailored and personalized services.

For this project, students will focus on our Digital AI Backpack project. The Digital AI Backpack seeks to create a centralized, structured database of financial, educational, and professional opportunities that Conectado users can access. Linker Finance is developing an App that can allow Conectado users to access a centralized database of resources and opportunities available in the Conectado platform.

Problem(s)

There is no centralized, standardized, structured database of opportunities for students, and they are all managed by different organizations; some of them have APIs, some of them are posted in Content Management Systems, some even on an image or document format such as JPG and PDF. Coordinating this effort would be prohibitive, yet the information is available, making it an interesting task for applying AI methods.

Objectives

Extract and store inside a structured database a set of opportunities for students (i.e., internships, jobs, gigs, scholarships, grants), including important metadata such as name, description, URL for applying, application deadline or deadlines, and important dates. The algorithm should also create meta tags relevant to the opportunity, which can be later used by a recommender algorithm matching opportunities to specific students.

This project is recommended for a student and/or group of students interested in Artificial Intelligence (AI) fields such as Text Recognition, OCR, LLMs (e.g., ChatGPT).

14. Taxiline Detection Using Machine Learning

Background

Omron Robotics and Safety Technologies, Inc. (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 robotics - including Selective Compliance Articulated Robot Arm (SCARA), articulated, parallel link, cobots, and autonomous mobile robots - for the global market.

Problem(s)

Omron's Autonomous Mobile Robots are connected to a central system called Fleet Manager (FM). The robots connected to the same FM operate as a single fleet. These robots perform obstacle avoidance and intelligent multirobot collision avoidance behaviors while navigating on the map, by extensively sharing data among themselves.

Taxiline is a feature in these mobile robots' navigation framework and runs on each individual robot every cycle. The primary function of this feature is to determine whether the robot needs to re-path plan around a stopped robot in its path. The feature ensures that if the leading robot is obstructed by an obstacle, the following robot that shares a similar path does not attempt to replan their path around the leading robot. Instead, it stops and waits for the leading robot to move. When a fleet of robots share a similar path, they essentially start queuing up which forms a "Taxiline". The feature avoids unnecessary replanning that could result in chaotic behavior, and promotes efficient, cleaner and orderly navigation.

Objectives

So given all the required data, the Taxiline algorithm essentially finds out whether the given robot is taxilining with the robot in the front and feeds the result to the replanner. The existing algorithm, which is deterministic and rule-based, has many unaddressed edge cases. To handle all the edge cases and to improve the accuracy, we are considering a machine learning based approach.
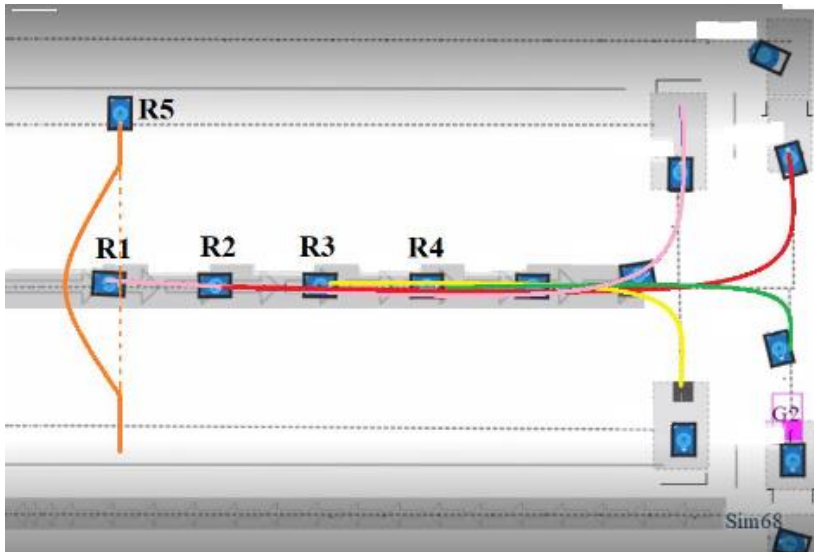
Following is a real example: In the above picture, the paths for 5 robots are shown: Robot R1 (pink), R2 (red), R3 (yellow), R4 (green) and R5 (Orange). Ignore all other robots. R1 to R4, even though they are going to different final goals, since their paths are similar, they all just queue up behind one another without trying to replan around. But if you look at R5, its original path (straight dotted orange line) is obstructed by R1 and it replans around R1 as R5 is not "Taxilining" with R1 i.e., R1's path is not similar to R5's.

15. Online Battery Discharge/Charge Time Estimation

Background
Omron Robotics and Safety Technologies, Inc. (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 robotics - including Selective Compliance Articulated Robot Arm (SCARA), articulated, parallel link, cobots, and autonomous mobile robots - for the global market.

Problem(s)
Mobile robot charge/discharge time is an important parameter customers use to select a robotics supplier. Our current estimation method could be improved using data that can be gathered from the robot power station including:
- State of Charge
- Instantaneous Charge Current
- Instantaneous Discharge Current
- Remaining Battery Capacity
- Max/Min Temperature

Objectives
Estimate the remaining discharge time/charge time based on current as well as from the previous data.
- Multiple standard methods need to be identified both deterministic and probabilistic methods.
- These methods should be evaluated to identify the best estimation method.
- Limitations and assumptions associated with these methods should be established.
Test formulated method on batteries with different chemistry (Li-ion based)"

16. Deadlock Prevention/Recovery for Mobile Robot Fleets

Background
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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 robotics - including Selective Compliance Articulated Robot Arm (SCARA), articulated, parallel link, cobots, and autonomous mobile robots - for the global market.

Problem(s)

A deadlock in a fleet of autonomous mobile robots (AMRs) refers to a situation where two or more robots are unable to move due to mutual blocking, which means each robot is blocking the path of another robot. This results in a state of the system where none of the robots can move forward and continue their jobs, and the entire system is stuck in a deadlock. When a deadlock happens in Omron AMRs, it requires manual intervention. This not only affects the production cycle time and efficiency of the fleet, but it also makes the "intelligent" robots look dumb.

Deadlock recovery is a mechanism used in robotics to resolve deadlocks by identifying them and taking appropriate actions, such as modifying the trajectories of one or more robots that are stuck in the deadlock.

Deadlock prevention is a mechanism where the deadlocks are predicted beforehand, and the robots' trajectories are modified in such a way that the deadlocks don't happen in the first place. One other way to predict and prevent deadlocks is to change the order of jobs that are picked by the robots.

Objectives

Omron team has already developed some algorithms to recover the robots out of a deadlock. But they don't work for all the scenarios. Deadlock prevention is even a tougher problem and there's no solution for it yet.

Machine Learning/Reinforcement learning is one option that Omron team is considering to recover the robots out of deadlocks.

17. Building a Database for Community and Mentors Engagement

Background

INNOVIT is the premier Italian Innovation and Culture Hub, promoted by Italy's Ministry of Foreign Affairs and International Cooperation and coordinated by the Consulate General of Italy in San Francisco and the Embassy of Italy in Washington DC. Located in the heart of San Francisco, INNOVIT embodies Italy's long-term commitment to technological innovation and to strengthening ties with the Bay Area and the US ecosystem. Through acceleration programs, strategic partnerships, and international initiatives, INNOVIT connects the vital resources of Silicon Valley with the best opportunities offered by Italian businesses. We are the bridge that links Italian excellence in entrepreneurship, culture, research, and technology to the global future. INNOVIT designs and delivers acceleration and innovation services for Italian companies, startups, universities, and scientific centers.

Problem(s)

This project is focusing on designing and building the INNOVIT community database, with a specific focus on mentors and community. The Mentors database is critical to deliver startup acceleration programs, while the Community Database is critical for launching marketing and engagement activities. Without a well-designed database the operational activities of a strategic project like INNOVIT cannot run properly as the program is scaling rapidly. During the last 6 months alone, more than 3.000 people have joined +40 events, while more than 60 startups have participated in 2 acceleration programs involving more than 100 mentors.

Negotiable constraints are related to INNOVIT team support, data entry, deadlines, and project expansion to other areas like Visitors registrations, Sales and Booking systems.

Non-negotiable constraints are mostly centered around users' experience and key requirements.

Objectives

The team is asked to perform interviews, requirements analysis, and implementation. At the end of the semester, we are expecting to have a fully implemented database with a user-friendly UI.

18. 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 database system does not function appropriately to manage members, and the data entered does not transfer to our other 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. The task at hand is to develop two separate websites that will be linked with one central database that has been built by last year's capstone team.