



2023 PROJECT DAY

April 1, 2023
8:30 am - 4:30 pm
Education Building



FACULTY OF
**ENGINEERING &
APPLIED SCIENCE**

Welcome To PROJECT DAY 2023!

The Faculty of Engineering and Applied Science is proud to present **PROJECT DAY 2023!**

This conference-style event includes concurrent sessions where 4th year Engineering students present their final year design projects, and a Trade Show & Poster Session where projects will be on display.

The Trade Show & Poster Session gives you the opportunity to speak to students directly about the projects that interest you and/or your organization.

To learn more about each project, feel free to attend any presentation.

The University of Regina is situated on the territories of the nêhiyawak, Anihšīnāpēk, Dakota, Lakota, and Nakoda, and the homeland of the Métis/Michif Nation.

The University of Regina is on Treaty 4 lands with a presence in Treaty 6.

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*“Nothing is impossible, the word itself
says 'I'm possible'!”*

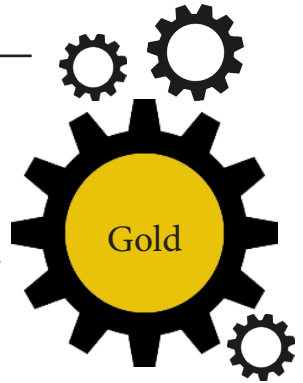
- Audrey Hepburn

Sponsorships



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Advance Engineered Products Group
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Ministry of Energy and Resources
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The U of R Engineering Project Day event would not be the success it is without the continued support of the engineering community in Southern Saskatchewan. This community supports us through project mentoring, evaluation feedback during the day, and also through direct financial and in kind support. Donors that have supported us over many years include:



ALFA Engineering Ltd.
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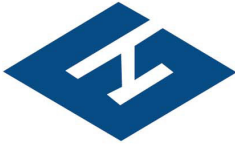
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To these long time supporters, and to all who help make Project Day a success we say **Thank You!**

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A P E G S

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APEG S is the self-governing organization responsible to the people of Saskatchewan for licensing engineers and geoscientists in the province, and for regulating the practice of these professions in the public interest.

APEG S ensures high standards of engineering/geoscience practice and education in Saskatchewan, by setting high standards for admission into the profession, by disciplining engineers/geoscientists who fail to uphold the profession's practice and ethical standards, and by preventing the misuse of the title "engineer" and "geoscientist" by individuals who are not licensed members of the professions.

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The Petroleum Technology Research Centre (PTRC) is a not-for-profit corporation founded in 1998 to facilitate research, development and demonstration projects to reduce the carbon footprint and increase the production of subsurface energy. PTRC seeks to support industry, governments and research providers to realize their environmental, social and governance needs.

Founded by four partners - Natural Resources Canada, the Government of Saskatchewan, University of Regina and the Saskatchewan Research Council - the PTRC has fostered the expansion of research capacity in Saskatchewan and Canada through funding and facilitating projects that are important to addressing the challenges faced by the energy industry.

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SaskWater

SaskWater is Saskatchewan's commercial Crown water utility, helping communities, First Nations and industry gain access to reliable and professional water and wastewater services.

SaskWater provides professional water and wastewater services to 63 communities, 10 rural municipalities, 81 rural pipeline groups, 17 industrial and 242 commercial and end user customers. SaskWater's services directly and indirectly reach approximately 102,000 people in Saskatchewan.

In order to provide these services, SaskWater owns nine water treatment plants, 967 km of potable and non-potable water pipeline, 140 km of canal as well as three wastewater facilities, including 15 kilometres of wastewater forcemain. SaskWater also owns or leases 39 booster and pump stations across the province.

Sponsors

Thank You!

A big thank you to the people who help make Project Day possible:

- Sponsors
- Industry Evaluators
- Student Volunteers

Thank You from the Dean of
Engineering & Applied Science!

Electronic Systems Engineering

ESE 1: Wellphone - SmartPhone LockBox

Jadon Donais

Sharmarke Hassan

Curtis Ficor

Excessive mobile device use by children is creating a future that is drastically impacting our lives. Early exposure to these devices without proper control can lead to dependency, resulting in mental lethargy and a desire for instant gratification. As a result, this impacts our ability to build a healthy foundation for our lives. Our solution consists of a Lock-Box, sleep monitoring sensors, and interactive research proven activities related to wellness, aimed to help build healthy night time and morning habits early on in life through an incentive based approach.

ESE 2: Full Body Human-Machine Interface for Balance Rehabilitation

Isaac Labrie-Boulay

Harith Abdulkareem

Benjamin Pullar

In order to perform research on the viability of utilizing video games for increasing exercise retention, kinesiology researchers at the University of Regina tasked us to develop a human-machine interface system for virtual reality (VR) games they are developing for balance rehabilitation. Our system combines center-of-mass tracking via a custom built force-sensitive mat and exercise recognition using computer vision. Data from both subsystems are fed as inputs for a video game. The center of mass is mapped to an analog joystick and the exercises are translated to digital inputs. To prioritize safety and ergonomics, the system does not require sensors to be physically attached to its users.

Electronic Systems Engineering

ESE 3: Magnetic Manipulation of Non-Ferrous Metals

Braydon Walker

Nicholas Altwasser

Small space debris is a growing threat to spacecraft. Due to the size of the debris (<5cm) ground based detection stations are unable to track these objects, making traditional collision avoidance methods difficult. Based on a request from Magnestar, a system to remotely manipulate non-ferrous objects was designed to demonstrate the feasibility of moving debris out of the collision path of a spacecraft. Using a ferromagnetic core surrounded by three electromagnets, eddy currents can be induced in non-ferromagnetic debris resulting in a force. By varying the strength of each electromagnet with a custom driver module, the direction and magnitude of the force can be controlled, moving the object out of the collision path with the spacecraft. This test system will aid in the future development of improved algorithms and electromagnet design for controlling the manipulation of debris.

ESE 4: SafeSnooze

Ayden Mack

Matthew Landry

Sharjeel Arif

SafeSnooze is an innovative baby monitoring system that aims to provide parents with crucial information about their infant's well-being while in a crib. The system is equipped with sensors that continuously monitor the baby's position and vitals and provide updates to the parents every few seconds. This feature ensures that parents are always informed about their baby's state, even when they are not in the same room. The system also has the ability to detect and alert parents if their baby is in an undesirable position. Additionally, SafeSnooze comes with a fully automated entertainment system that uses computer vision, machine learning, and ambient noise detection to detect if the baby is awake and then soothe them back to sleep. SafeSnooze is a highly sophisticated baby monitoring system that combines cutting-edge technology with safety features to provide parents with peace of mind.

Electronic Systems Engineering

ESE 5: Harmonics Metering Device

Rupinder Arora

Ivyshane Nimer

Higher levels of current harmonics can have a significant impact in an electrical system. Most equipment in an electrical system does not have the ability to withstand extreme temperatures. Harmonics can cause extreme and potentially damaging temperatures. We are tasked by U of R Facilities Management to design a cost-effective Harmonics Metering Device capable of determining the current magnitude and harmonics feeding the Power Factor (PF) Correction Unit. The device notifies Facilities Management when current levels exceed normal operating conditions via an alarm. Current Transformers (CTs) are installed on each phase of the conductor going into the PF unit. The incoming signal from the CT is conditioned and then processed using an algorithm to obtain the individual current magnitude and harmonics on each phase conductor. Users have the ability to determine various alarm conditions. The device is useful for gauging the power quality by quantifying harmonic distortion and in aiding the design of harmonic filtering. Additionally, the device can be used to meter existing equipment in order to improve the overall efficiency and performance of the electrical system.

ESE 6: ZXP Wireless Smart Home System

Xinhang Peng

Lisong Zhang

Zhecheng Xie

Taking care of a house can be taxing. This project is a wireless smart home system that uses Wi-Fi and LoRa protocols to automate and monitor various home devices. It includes three subsystems: temperature/humidity system, lighting system, and security system. The whole project consists of a central host, sensors, and smart devices that are connected through wireless networks. The system allows users to control and monitor their devices remotely through a mobile device using a web interface. The project aims to increase the convenience, comfort, and energy efficiency of a home while also prioritizing security and privacy.

Electronic Systems Engineering

ESE 7: Drowsy Driver

Mayer Javed

Aesham Saeed

Driving for extended periods of time, particularly on long routes, can lead to fatigue and increase the risk of fatal accidents due to drivers falling asleep behind the wheel. Fortunately, technology exists to mitigate this risk in the form of facial recognition devices that can detect drowsiness and alert the driver accordingly. Since many drivers may not recognize the signs of fatigue, an audible alert system may help to prevent accidents. As part of our capstone project, we are developing a device that utilizes a camera and facial recognition technology to constantly monitor the driver's head pitch angle and eye activity, allowing it to detect signs of drowsiness or closed eyes. Additionally, the device incorporates a steering wheel detection system which serves as an additional method of determining whether the driver has lost focus. The device also contains a GPS module that can determine the location of the device and check to see if the vehicle is in motion. When the device detects distraction, it triggers an audible warning sound through a built-in speaker to remind the driver to take a break. Overall, this device provides a supplementary solution to the problem of driver fatigue on long routes, using multiple sensors and advanced technology to detect and prevent potential accidents.

*“What you get by achieving your goals
is not as important as what you become
by achieving your goals.”*

- Zig Ziglar

Environmental Systems Engineering

EVSE 1: Design Solutions for Wascana Parkway and Ring Road Overpass

Traffic Congestion

Carter Henderson Seth Reddekop Austin Nakonechni
Sam Debia

The Wascana Parkway and Ring Road Overpass is a bridge and road structure located in Southeast Regina, near the University of Regina campus. Studies demonstrate that the south ramp intersection on the overpass is currently operating at a failing Level of Service (LOS) during peak hours of traffic volume, resulting in traffic congestion on the overpass and surrounding areas, and high delay times experienced by motorists. Four design alternatives are proposed to mitigate traffic congestion on the overpass: diversion road routing, free flow loop, roundabout intersection, and diverging diamond interchange. Using PTV Vissim traffic modeling software, Geographical Information System (GIS) software, and expert judgement, the four design alternatives are evaluated based on LOS, construction cost, traffic volume, and collision reduction. Analysis of the four design alternatives show that the roundabout intersection is the most effective design solution to mitigate traffic congestion on the overpass. The roundabout intersection is modeled using Solid Edge, a Computer Aided Design (CAD) software. The computerized model of the roundabout intersection is also 3D printed to provide a physical model of the design.

EVSE 2: Subdivision Design South of Assiniboine Ave in Regina:

A Case Study

Callyn Burns Eric Maximuik Mathew Saleski
Lambry Stamatinos

Subdivision design is a vital aspect in every community. A well-engineered subdivision can drastically improve residents satisfaction and quality of life. This project aims to design a subdivision south of Assiniboine Ave in Regina, behind the Riverside Memorial Park Cemetery. A survey was conducted prior to the design over a total area of 225 acres. The survey outlined both sides of Wascana Creek and gathered all topography up to the fence line surrounding the cemetery. A small portion of this area will be used for the subdivision in accordance with the City of Regina Growth Plan Map and results from a flood plain analysis. HEC-RAS and Civil 3D are the main software supporting the design of the subdivision. All environmental aspects will be designed and engineered including cadastral elements; water, sanitary sewer, and storm sewer pipe networks, traffic control, and basic grading. The final design will be comprised of 553 low density residential lots and four commercial lots. This design project endeavours to comply with all bylaws and regulations.

Environmental Systems Engineering

EVSE 3: Value-Added Product from Water Treatment Waste Streams

Ariana Doucet

Sydney Flaman

Johanna Marie Ricafort

Meissa Marpole

Dating back to the aqueducts of the Roman Empire, the great societies of the world have prioritized the reliable supply of safe clean water. Water treatment infrastructure is necessary to facilitate thriving human life, and methods have been developed to ensure water from various sources can be made potable. One such process is the addition of metal salts, such as polyaluminum chloride (PACl), to influent water to facilitate particle coagulation and flocculation. This crucial coagulation process yields a by-product, called sludge, with high concentrations of aluminum. The sludge is traditionally dewatered through freeze-thaw and evaporation, then hauled to landfill at the expense of the treatment facility. This places a financial burden on the treatment plant and may have negative effects on the environment, such as leaching of metallic elements. International literature suggests that water treatment waste contains valuable chemical and mineral components which may be reclaimed and used to create a value-added product. Using water treatment residual (WTR) from the Buffalo Pound Water Treatment Plant (BPWTP), which serves two of Saskatchewan's largest cities, the group will work in-lab to synthesize a viable product to create a revenue stream. This pursuit is in line with numerous UN Sustainable Development Goals, which strive to improve infrastructure and processes for the benefit of future generations. Through literature review, experimentation, and analysis, ceramsite granules were selected, created, and tested to reveal specific material qualities including compressive strength and nutrient adsorption. On a larger scale, the sale of this product could provide revenue for BPWTP. This is deemed to be a noble and sustainable cause, as the success of this WTR reuse process would divert sludge from the landfill, directly protecting the local water table from potential metals contamination, while simultaneously offsetting the current \$1,000,000 spent annually by BPWTP on sludge disposal.

EVSE 4: Small Reservoir Management and Utilization for Usage in

Southwest Saskatchewan Under Drought Conditions

Changbo Liu

Kiana Avery

Morgan Moore

Nathan Prisiak

Climate change is continuing to have an increasingly noticeable effect on seasonal weather patterns around the world, resulting in warmer temperatures and drier conditions. One considerable concern resulting from these unprecedented conditions is the negative impact they can have on reservoir water reserves. Currently, in southern Saskatchewan, there is no framework available for the management of these water reserves under drought conditions. To address this issue, the current project was implemented to develop a reservoir screening tool that predicts reservoir water storage changes based on environmental factors such as inflow, outflow, evaporation, irrigation, precipitation, and seepage. The screening tool will allow professionals to make informed decisions on how to utilize the reservoir water under drought conditions to mitigate adverse impacts on irrigation, water shortages, feed shortages, and unstable economies. The Duncairn Dam reservoir near Swift Current was selected as the study site. The reservoir provides water for irrigation, serves as a migratory bird sanctuary, is used for recreational activities as well as supplies drinking water and flood control. The completed screening tool enables professionals to predict the reservoir water storage under two different drought types, namely intensity, and duration. Which could provide a better understanding of the drought impacts to water management in both short and long term scenarios in the province. The project works toward ensuring availability and adequate sustainable water management in not only southwest Saskatchewan but Canada as a whole.

Environmental Systems Engineering

EVSE 5: Utilizing Bio-Cementation to Mitigate Calcite Formation in the Elk Valley Watercourses

Duha Abdullah
Zhihao Zhao

Jayden Pederson

Reid Balkwill

As part of the coal mining extraction process, the above ground layers of soil, vegetation, and rocks are excavated, and the non-profitable rocks are accumulated in piles with high porosity and significant free-draining surfaces. At Teck Resources mining operation in the Elk Valley, British Columbia, dissolved calcium and carbonate ions in the mine waste rock in combination with water runoff, are forming calcite downstream. Calcite formation restricts Westslope Cutthroat Trout from spawning, therefore, reducing their population. The objective of this project is to evaluate the potential of microbial-induced calcite precipitation (MICP) otherwise known as bio-cementation, to minimize runoff infiltration through the waste rock pile at the Line Creek site in the Elk Valley. *Sporosarcina Pasteurii* is the chosen bacteria strain to theoretically calculate the MICP process for an extensive field-scale application. The project will briefly compare MICP through the method of injection with a reverse osmosis upgrade to an existing water treatment plant at Line Creek. This consists of an analysis of feasibility, field scale influencing factors, and environmental impacts.

EVSE 6: Lagoon Wastewater Treatment Retrofit for Carry the Kettle Nakoda Nation

Rae Smith

Parker Hodel

Zachary Moore

Carry the Kettle Nakoda Nation is a growing community with an undersized facultative lagoon wastewater system. Currently, the wastewater generated by the community is exceeding the lagoons treatment capacity due to the population growth. As a result of this issue, the community is bypassing excessive untreated wastewater into a septic field, which may cause environmental concerns. Effluent quality has previously exceeded standards due to inadequate treatment. The parameters of concern are ammonia, biological oxygen demand (BOD), and total suspended solids (TSS). This project aims to develop three retrofitted options and determine the best one to help the community to meet its wastewater treatment requirements for the next 20 years. The designs must either reduce the hydraulic retention time to allow for shorter holding periods or expand the lagoons to the projected sizing requirements. The chosen design should be low-cost, easy to operate and maintain, and should ensure the effluent quality meets regulatory criteria.

Environmental Systems Engineering

EVSE 7: The Preliminary Design of a Culvert Drop Structure in Northern Saskatchewan

Farzad Alizadah

Maria Imran

Harroop Kalkat

This capstone project is focused on the design of culvert drop structure replacement for a culvert located on CS 35 - 17 at km 9.70, roughly 50 km northeast of Prince Albert, SK. The existing culvert was a drop structure with a 90-degree drop, suffered from erosion and scouring on the downstream side slope due to failed couplers. Two design alternatives will be proposed to mitigate erosion or leakage from occurring. These particular designs will be constructed based on the current data presented to us by the MoH. Additionally, we will be creating our own methodology on how to create and construct our own drop structure. The project's goal is to examine each design alternative's hydraulic performance and efficacy in meeting project objectives. The design methodology phase includes hydraulic calculations, cost-estimate, procedures and will be done for our chosen alternative to optimise the size and configurations of the proposed alternatives. Two proposed alternatives for the design were explored. According to the study findings, both recommended designs are excellent in controlling erosion, flow rate, and providing a stable streambed. The proposed alternative with a deflector wall and floor baffles provides a more smooth flow transition, decreasing turbulence and preventing scour downstream, whereas the second alternative design with several overlapping flaps and a divider wall at the base provides better flow control, lowering energy dissipation and boosting hydraulic efficiency. Both designs meet the required water flow, fostering healthy stream conditions, delivering efficient hydraulic performance within Saskatchewan's Hydraulic Manual standards and requirements. Additionally, the two design alternatives are modelled using SolidEdge, a Computer Aided Design (CAD) software, and printed using a 3D printer to provide a visual representation of culvert drop structures on Project Day.

Industrial Systems Engineering

ISE 1: Static Inter-Mixer for Blended Co-Extrusion Based 3D Printing

Andrew Rowe

Chance Smith

Dawson Halstead

Erik DeRosier

This project outlines the innovative design of a static inter-mixer used in extrusion based additive manufacturing applications. Currently, there is no machine available that can blend different types or colours of materials that are used in extrusion 3D printers. For this project, a custom extrusion hot end and internal mixing geometry have been designed to provide a streamlined process for extruding a new blended material from the input feed stocks via mechanical keying.

ISE 2: Integration and Automation of HVAC Laboratory Equipment

Brayden Angus

Andrew Markewich

Tyler Sabiston

Robert Hunter

The design of heating, ventilation, air conditioning, and refrigeration systems for building comprise a large sector of the engineering consulting industry. In an effort to better prepare students for industry, the University of Regina's Industrial Systems Engineering program has developed an elective class to learn the fundamentals of these systems. Over the last three years, equipment has been developed by project groups to use in the laboratory component of the course. In the lab, students acquire hands on experience with equipment very similar to that seen in industry. In this project, the previously constructed hydronic heating and refrigeration units will be connected to the variable air volume box and fan coil unit to provide heating and cooling to the air. To accomplish this, a system of piping, pumps, and a heat exchanger will be designed to transport hot and chilled water to the coils while allowing the units to be easily disconnected for transport. All of the three units mentioned will be capable of operating independently or as a single interconnected system. In addition, the project also involves the design of a building automation system which will actuate the pumps and valves to regulate zone temperatures set on thermostats and demonstrate the functionality of a real building's HVAC system.

Industrial Systems Engineering

ISE 3: Automated Brine Sample Collection System

Aaron Richter
Nikita Melnyk

Spencer Jorgenson

Maverick Olate

The automated brine sample collection system aims to increase the accuracy and intervals of testing at the K+S Bethune Solution Mine. With the increase of the sample accuracy, a decrease in the refinement of lower-quality brine will save time, money, and energy.

ISE 4: Low Cost Aerosol Jet Printer

Moses Onion
Sunith Rajeev

Muhammad Shoaib

Hamza Said Ahmed

Aerosol jet printing is often a costly additive manufacturing technique used in industry. Using a household humidifier and custom deposition head, the printer will be able to provide a uniform coating on various substrates such as polymer and glass. This ensures a low cost and yet an effective method of jet printing is developed.

“Set your goals high, and don't stop till you get there.”

- Bo Jackson

Industrial Systems Engineering

ISE 5: Safety Mechanism of Welding Positioner

Emma Hulbert

Nycole Russi

Ericka Bathan

Thomas Lukose

The custom-built welding positioner at Advance Tank Engineered Products Group is currently not in use due to the lack of safety features. A locking mechanism is designed to prevent a vertical drop of the 6000 lb trailer subframe chassis being lifted and rotated along a height of 5ft. An external attachment is mounted to the previous welding positioner to increase the safety factor and decrease the companys production time during the manufacturing process. The proposed design features ratchet tracks, spring-loaded pawls, and electromagnetic release mechanisms mounted on the side of the head and tailstock positioners. As the positioner raises the subframe, the pawl slides along the ratchet teeth to allow linear upward movement while restricting downward motion. An electromagnetic release operated by a push/pull lever is used to disengage the pawl in order to lower the workpiece.

ISE 6: Engineering the Future of Flax Harvesting: Evaluating and Improving the Flax Buncher Design

Kristaps Uskanovs

Satinder Sandhu

Hamza Khan

Sohaib Ur Rehman

The rotary flax buncher is a relatively new piece of equipment in the maret and was developed by a local farmer. With the goal of mass production, the objectives are to re-evaluate some of the key components of the flax buncher, such as the rake catch, activation, and materials used. With this in mind, the new design aims to improve flexibility, adjustability, and maintainability, all while giving the farmer a smoother experience using the new wireless method of rake activation.

Industrial Systems Engineering

ISE 7: Adaptive Rehabilitation Device for Fingers

Dane Fichter

Janine Andrea Morales

Mathew Martineau

Sheetal Kaushal

Hand injuries are the most common occupational injury in Saskatchewan with Saskatchewan Workers Compensation Board having received 3,282 claims in 2021. This project focused on designing a cost effective and adaptive rehabilitation device to effectively and efficiently reduce the downtime caused by hand incidents by restoring the range of motion and strength to the hand. Initial research explored different hand injuries, physiotherapy practices, 3D printed materials, and existing rehabilitation devices. The innovation of a 3D printed device for locking joints to enable isolated rehabilitation exercises with an electronic measuring system to track and motivate progress was designed and prototyped. The project delivers risk analysis of the design, an assessment of 3D printed material to assess both material and manufacturing processes, device analysis of functionality and its durability and lifespan, bill of material with cost analysis and instruction and support documentation. An adaptive finger rehabilitation device for various sizes and types of hand injuries has been successfully designed, prototyped, and assessed.

ISE 8: Granular Mineral Thermal Energy Storage

Arthur Gomes Genn

Wangwe Prince Peter

Lilian Kangethe

Suchita Barua

Due to increase in demand for renewable energy and its unreliability, there is a need for energy storage systems that counteract this problem. The purpose of this project is to design a thermal energy system that stores excess energy produced by these sources and uses this stored energy in the form of heat to heat homes, heat green houses during winter or for some process industries that require moderate amounts of heat. The major aim of the project is storing this excess energy for long periods of time using granular mineral material that is cheap, readily available and has a high volumetric heat capacity. To limit the loss of heat energy the surrounding several layers of insulation are necessary around both the storage system and the pipes. The system consists of the storage unit, two heat exchangers, one that supplies heat to the storage and one that takes heat out of the system, by heating water for radiant heating system, and a fan.

Industrial Systems Engineering

ISE 9: Commercial Energy Audit for All Nations Hope Network

Trevor Ficor Branden Janotta Marcell Madar

All Nations Hope Network (ANHN) is a non-profit organization that provides support and services to First Nations communities who are affected by HIV and Hepatitis C. The organization operates out of the Red Ribbon Place building, located in North Central Regina. For this project, ANHN has requested an energy audit of Red Ribbon Place to improve its current state and apply for federal funding. Commercial energy audits involve the analysis and evaluation of the energy consumption of the building to determine possible improvements to reduce electricity and natural gas usage. The process consists of meeting the client, doing a building walk through, reviewing past utility bills, creating a baseline simulation of the building energy usage with energy modeling software, testing possible recommendations with the baseline model, conducting an economic analysis on the possible recommendations to determine the ideal solutions for the client, and providing an energy assessment report to the client. The suggested alterations for Red Ribbon Place will improve the energy efficiency of the building while ensuring that ASHRAE and National Building Code Standards are met. The findings from this energy audit will be used in application for the Green and Inclusive Community Buildings Grant (GICB). The City of Regina's goal of becoming a net-zero city by 2050 will also be considered in any building improvements.

ISE 10: Rotary Arm Attachment Designed for Electric Pallet Jack to

Stretch-wrap Pallet

Darsh Patel Niravkumar Patel Nisarg Dodia
Shubham Bansal Swelin Macwan

The purpose of this capstone project is to design a semi-automatic stretch-wrapping machine that can be attached on top of the battery casing of the existing electric pallet jacks used for moving single pallets. Whenever products are shipped from the food distribution centers, goods are primarily secured using stretch wraps. Currently, food distribution centers across Canada like Loblaw's or Sysco use semi-automatic static rotary arm machines and robotic machines. This project deals with replacing the high-cost robotic and static stretch-wrapping machines with a lightweight and low-cost stretch-wrapping attachment mounted on the electric pallet jack. This project presents a new design and approach of retracting and extending the rotary arm to stretch-wrap the pallets. The report goes into detail about design specification, finite element analysis, safety, automation, and calculations for sizing base structure along with the complete cost analysis of the design. The project also goes beyond the scope and implements automation for the newly designed stretch-wrapping machine to reduce any unnecessary human-machine interface for safety purposes.

Petroleum Systems Engineering

PSE 1: Modal Analysis In Dynamic Piping Using CAESAR-II

Rishabh Dutta

Yeqi Liu

Modal Analysis is a technique used to study the natural frequencies of vibrations in a specific piping system in order to analyze any defects that may be present. This is important because under dynamic conditions load is not evenly distributed. This can cause unbalanced forces to act on the pipe leading to movement or damage. By conducting modal analysis, the movement in different parts of the piping structure can be determined. Our focus will be on Modal Analysis, which is one of several types of Dynamic Analysis, and we will be using CAESAR II software to perform the analysis. This software will allow us to break down the complex piping system into multiple modes of vibration, each with its own unique vibration response. The aim of the pipeline stress analysis by CAESAR II is to ensure that the pipeline has sufficient flexibility to prevent fatigue failure caused by thermal expansion and contraction, pipeline support, or additional displacement at the end points. The results from the analysis will guide us in repositioning and rearranging valves, bends, reducers, tees, and other components to increase safety and reliability, and ultimately strengthen the overall integrity of the system. Furthermore, the dynamic analysis results will be incorporated into the Pipeline Integrity Management Plan (PIMP) to ensure that the pipeline does not fail during extended periods of operation. An economic analysis will also be conducted to support the feasibility of the proposed modifications.

PSE 2: Geological Modelling and Optimization of Heavy Oil Recovery using CO₂-EOR and Sequestration in Lloydminster Area

Farhah Mohd Fadzli

Abdurahman Hassan

Faisal Shehu Mahe

CO₂-based cyclic solvent injection (CSI) has become one of the most feasible methods among the solvent injection process to maximize oil production in heavy oil reservoirs. This project targets the heavy oil wells in Lloydminster, located on the AB/SK border. The reservoirs in this area have been pressure-depleted by Cold Heavy Oil Production with Sand (CHOPS) due to the highly viscous nature of the reservoirs and excessive sand production. The current method only recovers up to 10% of the Original Oil in Place (OOIP), therefore the implementation of the CO₂-CSI method is required as an effective follow-up procedure to boost the recovery factor. It is also crucial to consider the capacity of the reservoirs for the CO₂ sequestration process, which must be long-lasting and safely deposited, as an increase in oil production would mean a higher volume of CO₂ is injected into the reservoirs, thereby requiring more underground CO₂ storage. This project aims to identify a suitable pool from the Lloydminster area that satisfies specific criteria. The selection will be based on factors such as; storage capacity potential, caprock thickness, pressure, temperature, and density. To determine these parameters, the ACCUMAP and ACCULOG software will be utilized. Once a suitable pool and well have been identified, CMG software will be employed to create a 3D geological model. CMOST software will then be used for history matching, and a simulation will be conducted to estimate the technically recoverable oil via the CSI process.

Petroleum Systems Engineering

PSE 3: CO₂ Phase Behaviour and Sequestration in Deep Saline Aquifers

Deng Magiir

Abdiaziz Guled

The purpose of this Capstone project was to perform a CO₂ phase behavior analysis and sequestration in deep saline aquifers. Deep saline aquifers are paramount as they are designed to store large capacity for saline CO₂ as a greenhouse gas. Therefore, storing atmospheric CO₂ in deep saline aquifers is a remedy that helps in mitigating the high CO₂ levels from the atmosphere caused by human-related activities such as the burning of fossil fuels, industrialization due to the industrial revolution, population growth rate, and other CO₂ trapping mechanisms. In this study, CMG WinProp software was used to generate CO₂ phase behavior properties, and the results were exported to Excel to analyze the relationships for PVT properties, CO₂ saturation pressure, and phase envelopes, constant composition expansion for gas components among other CO₂ properties under various temperature and pressure conditions. CMG Builder software was used to build a saline aquifer CO₂ geological sequestration storage model, and single-layered, double-layered, and triple-layered fractured reservoir models were designed. By creating a fractured system on CO₂ saline aquifer storage, the performance of CO₂ in the deep saline aquifer will be affected such as possible CO₂ leakages. Therefore, the effect of the fracture system on CO₂ saline aquifer storage performance will be analyzed by performing a CO₂ injection/falloff test, a safety test under various reservoir saline conditions, that was used to determine the rate at which CO₂ leaks out/dissipates from the CO₂ saline aquifer storage facility/tank using KAPPA Saphir software. Other simulation results such as gas rates, and bottom hole reservoir pressure were then generated using CMG Results software.

PSE 4: Investigation of Influences of Viscous Fingers in Miscible Displacement EOR Process

Mohamed Muse

Deep Patel

Viscous fingering is a common phenomenon that occurs when a low-viscosity fluid displaces a higher-viscosity fluid in porous media, leading to the formation of finger-like channels that reduce the efficiency of fluid displacement. In miscible displacement EOR, this can significantly impact the recovery of oil from reservoirs. The study begins by providing an overview of the miscible displacement EOR process, including the different mechanisms involved in fluid displacement and the key factors that affect the efficiency of the process. This is followed by a detailed analysis of the causes and effects of viscous fingering in miscible displacement, including the physical mechanisms involved in the formation of fingers and the factors that influence their growth and stability. Viscous fingering can reduce the effectiveness of this process by allowing the injected fluid to bypass significant amounts of oil, reducing the overall recovery efficiency. Therefore, mitigating the effects of viscous fingering is crucial to maximizing the efficiency of enhanced oil recovery processes and improving the overall oil recovery rates. The study then presents a review of the current strategies used to mitigate the effects of viscous fingering in miscible displacement EOR, including the use of horizontal wells and CO₂ flooding. The effectiveness of these strategies is evaluated based on the results of previous experimental and simulation studies. Finally, the study presents a sensitivity analysis to evaluate the effects of different parameters on the growth and stability of viscous fingers, including fluid viscosity, injection rate, and reservoir permeability. The results of this analysis provide insights into the optimal operating conditions for miscible displacement EOR, with the aim of improving oil recovery efficiency and reducing the impact of viscous fingering. Overall, this study provides a comprehensive overview of the influences of viscous fingers in miscible displacement EOR and highlights the importance of further research in this area to optimize the effectiveness of EOR techniques.

Petroleum Systems Engineering

PSE 5: Thermomechanical Analysis and Pipeline integrity under static loading conditions

Adam Hmedat

Mukhled Alotaibi

Static loading conditions are a crucial factor to consider when analyzing the integrity of pipelines. It refers to the pressure exerted on the pipeline when it is in a stationary or motionless state. These conditions are typically characterized by a constant pressure, which can be either internal or external, applied over a long period. Such conditions can cause gradual changes in the pipeline's mechanical properties which can lead to failure or damage. In the context of pipeline operation, static loading conditions can occur due to a variety of factors. For instance, changes in temperature can cause thermal expansion or contraction which can exert pressure on the pipeline. External forces such as soil pressure, water pressure, and other environmental factors can also cause static loading conditions. To evaluate the impact of static loading conditions on pipelines, it is necessary to perform a thermomechanical analysis using software tools such as CEASAR-II. This analysis helps to determine the maximum stress and strain that the pipeline can withstand under static loading conditions. By doing so, potential weak points in the pipeline can be identified and appropriate measures can be taken to mitigate the risk of failure or damage. The evaluation of static loading conditions is critical for ensuring the safe operation of pipelines especially those used to transport crucial fluids and materials. It helps to identify any potential areas of concern and provides valuable insights into the overall health and reliability of the pipeline. Moreover, it enables pipeline operators to plan and execute maintenance and repair activities proactively.

“The whole purpose of education is to turn mirrors into windows.”

- Sydney J. Harris

Software Systems Engineering

SSE 1: URXperience - Connecting UR world

Dhruv Modi

Abraham Mugerwa

Dinesh Dalip

Favor Fasunwon

Students living in residence can interact online, meet friends, and achieve academic success thanks to URXperience. This website application enables communication among students through a chat feature and keeps them informed of current events taking place on campus via a digital event planner. In addition, a digital complaint box will make life in residence more comfortable by allowing problems or complaints to potentially be remedied right away. Students living on campus can feel more at home by ordering takeout or preparing meals at home thanks to the additional options that URXperience offers, such as Recipe of the Day and a list of nearby restaurants. With the help of this digital hub, students living on campus should have a better experience and get closer as a unit.

SSE 2: Event Buds

Alish Kadiwal

Ria Chevli

Event Buds is an event planning and management cross platform application that is supported on Web, mobile and tablets. This app allows users to add friends and helpers to help them complete tasks within the event. Users can also create events, browse public events, join public events and view user related data in a custom dashboard. Users and helpers can keep track of each task and its progress. It will also provide secure login functionality. There are other functionalities within the app that will make the application user friendly and provide a better user experience.

Software Systems Engineering

SSE 3: No More Waste

Arika Pasha

Bulbul Arora

Faizah Kolapo

Most restaurants throw away their excess food at the end of their work day when it could have been donated to homeless individuals. Many restaurants do not realize that shelters are willing to accept their excess food or they may not be willing to drop it off at the shelters. Restaurants can post about any excess food they have on No More Waste. Shelters can access the website to view the posts from various restaurants and request food on No More Waste. A volunteer delivery driver is then matched with the restaurant and will deliver the food from the restaurant to the shelter. With No More Waste, we want to provide restaurants an opportunity to donate their excess food and reduce their food waste with minimal effort on their part.

SSE 4: SPOT

Eric Chartier

Kyle Jakob G. Labatete

Yuting Li

Chirayu Patel

Getting a medical evaluation for every minor skin blemish can be a costly and time-consuming hassle that many individuals simply cannot afford. However, the consequences of neglecting skin health can be dire, as even small changes in the appearance or texture of the skin may indicate the presence of skin cancer or disease. Unfortunately, not everyone has access to medical facilities or the necessary knowledge to identify such conditions. That's where SPOT steps in as a game-changing solution. It is a cutting-edge AI-powered medical diary that provides users with a comprehensive and accurate assessment of their skin's health status. By utilizing advanced artificial intelligence technology, SPOT offers a quick, easy, and affordable alternative to traditional medical evaluations. Users can simply upload images of their skin blemishes or areas of concern, and SPOT's algorithms will analyze them to identify any potential skin cancer or disease. With SPOT, you can have peace of mind knowing that your skin health is being monitored by advanced technology, providing you with accurate and reliable evaluations. Although SPOT's assessment is not a substitute for professional medical advice, it empowers users to take informed action and seek professional assistance where necessary. By taking control of your skin health with SPOT, you can make informed decisions and take proactive steps towards maintaining your overall well-being.

Software Systems Engineering

SSE 5: Lost in Dungeon

Zhimu Li

Jiabo Zhang

In society today, the lives of people are becoming more and more stressful. Entertainment has become the primary solution to deal with stress for most young people and games are the most popular option. We decided to create a dungeon game with short playtime and simple controls. In the game, players can learn the controls and storyline from NPC dialog. The whole playtime will be 10-20 minutes and the randomness can increase the enjoyment of the dungeon game. This design allows players to have a different experience every time they play. Players can check the ability of monsters and items to build their own strategy to defeat the dungeon.

SSE 6: Investment Grade

Erika McCluskey

Hayden Jin

Finance and investing are scary concepts to many as there is just so much to know. Our goal is to make it fun and easy. Through the power of gamification and habit building, we have created a platform which provides bite-sized financial education to those who have been let down by traditional education systems. Our application has two primary features: lessons with interactive quizzes and paper trading. Daily lessons will encourage users to form healthy habits of learning while our paper trading section will allow users to apply their newly acquired knowledge in a simulated environment.

Software Systems Engineering

SSE 7: Achilles

Xiao Chu Zhao

Ahras Ali

Achilles is a mobile app that helps people manage their foot health without the hassle of visiting a podiatrist. The app allows users to self-diagnose their foot problems through a short survey and AI algorithms and is ideal for people unfamiliar with foot health who want an easy solution to their foot problems. Achilles is like a personal advisor that helps you understand your feet without requiring extensive medical knowledge. With the app, users can receive general diagnoses based on their symptoms and suggested treatment methods, saving time and reducing the need to spend hours at a podiatrist's office. In summary, Achilles is a mobile app that helps people manage their foot health in a simple and accessible way. The app provides a layer of abstraction between the user and the podiatrist, allowing users to receive general diagnoses based on their symptoms and suggested treatment methods. Whether calluses, bunions, or claw toes, Achilles is the perfect solution for anyone who wants to care for their feet.

SSE 8: ARC - Artificial Recognition of Cannabis

Greg Sveinbjornson

Feras Daghmoush

The Retail Cannabis landscape consists of an inconsistent and ever changing product mix - as a result the retailer is responsible for maintaining consistent product information. Cannabis is a live product and from batch to batch the terpenes' and cannabinoids' values will vary. Generally the inventory and product information will come from the point of sale system but almost always it is inconsistent or incorrect. Some software platforms are building data sets to help with this, such as BudSense, the startup we worked with. But even then they rely on a combination of retail partners and producers to do the leg work of manually inputting accurate product information to be displayed on menu boards. Our machine learning solution will enable retailers to quickly enter product information from packages as they arrive in the store in real time by taking pictures rather than using a lengthy manual input process. Our project has been designed to be easily imported into the BudSense workbench so cannabis stores can use our project inside their internal systems. Once implemented into their workbench, the accurate product data can go straight from a picture up onto the menu board.

Software Systems Engineering

SSE 9: C3PO

Nikita Khavronin

Shrey Patel

Nisarg Shah

Mayank Vashisht

The world is more connected than ever before. With subtitles and dubs available on all media, we can access more content than ever before. We felt that this same accessibility is not afforded to live-streaming. This service will use AI to translate live-streamed content to the language of the listeners' choice, making live streaming more accessible to people from different backgrounds. The users will be able to access the content they previously could not and the creators will be able to widen the pool of audience from which they can draw.

SSE 10: EzParking

Ziwen Tan

Yilin Ren

Zhuo Chen

Kecheng Yu

Driving is one of the preferred means of transportation for modern people and vehicles have brought people a lot of convenience. At the same time, finding a parking space is a problem that every driver must face. EzParking software is dedicated to recommending the nearest parking space through pre-set data and real-time data. It calculates the results and sends them to the client application to recommend which parking lot the user goes to, resulting in the shortest walking distance. A suitable parking space near the destination is very important for people as it can shorten the walking time for users to reach the destination. Therefore, it is necessary to have software that can query the nearest suitable parking space for the user. It saves the user time to find a parking space and avoids unnecessary walking distance for the user.

Software Systems Engineering

SSE 11: Movie Recommendation System

Xufeng Liu

Yixu Zhou

People always waste too much time selecting movies. Our system can recommend movies for our users according to their viewing history or search history. Users can also recommend their favourite movies to their friends. Our wish is that our users are all over the world, so they can even recommend some movies from different countries.

SSE 12: UniGo

Krupal Patel

Yash Patel

The University of Regina community, including students and faculty, faces challenges with their daily commutes, such as dependence on time-consuming public transportation, unreliability due to weather conditions, and long waiting times during Saskatchewan winters. To address these concerns, we (Team Due date is the Do Date) propose the development of a web-based application that facilitates carpooling and ride-sharing among the university community. This not only lessens the carbon footprint but also allows the car owner to earn a small amount.

*“The will to win, the desire to succeed,
the urge to reach your full potential...
these are the keys that will unlock the
door to personal excellence.”*

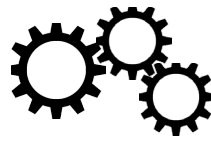
- Confucius

The Project Day 2023
Program is
sponsored by:



SaskWater

Feedback



This is the 24th Annual Project Day.

We would greatly appreciate your feedback on how things went.

Please send an email to engg@uregina.ca with your feedback

Thank you for helping us ensure next year is even better!

“Opportunity does not knock, it presents itself when you beat down the door.”

- Kyle Chandler

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