Interdisciplinary Capstone Symposium

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UNIVERSITY OF WATERLOO

Leia Minaker
Director

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Future Cities Institute Message

The University of Waterloo's Future Cities Institute (FCI), founded by CAIVAN, is proud to present the 2025 Interdisciplinary Capstone Design Symposium. This year, students from all six faculties collaborated on innovative projects aligned with FCI's mission of creating healthier and more prosperous cities and communities. Working alongside valued partners like the cities of Iqaluit, Moncton, Kitchener, and Waterloo, as well as the Sanguen Health Centre, RBC, Princess Margaret Cancer Centre, and the University's GEMM Initiative, students tackled real world challenges. We are incredibly proud of the students and their meaningful contributions towards shaping the future of our cities.

Capstone marks the culmination of the undergraduate student experience, providing a platform for students to showcase their ingenuity and design skills, in the classroom and beyond. Through projects aligned with FCI's focus on urban innovation, capstone teams engage with real-world issues outside the classroom, as a transitional educational experience that prepares them for the interdisciplinary and complex problems they can expect to face in their careers.

Capstone courses are offered across multiple programs and faculties, with approximately 2,000 UW students completing capstone projects each year. This course is distinguished by bringing together interdisciplinary teams across faculty boundaries and in alignment with FCI themes and project partners. Cities are complex and require multiple perspectives and approaches.

Capstone courses share common core components across all disciplines: opportunity identification, background research, ideation, empirical work, and evaluation. Though the particulars of these elements vary across disciplines, common threads emerge that in the interdisciplinary context of the FCI, facilitate innovative approaches to complex urban issues. By working together beyond traditional academic boundaries, students are uniquely positioned to offer solutions that truly meet the needs of our future cities.

Thank you to our capstone partners, project sponsors, expert advisors, TAs, support staff, and the Ideas Clinic. Capstone is truly a team effort at every level. Your leading examples of care and commitment have helped launch the students into their careers as compassionate and knowledgeable professionals.

Students: Congratulations on your impressive achievements! We're so proud of your dedication, creativity and the inspiring projects you've brought to life. We know that your innovative spirits will continue to shape the future of our cities long after graduation. Best wishes as you embark on your next exciting adventure!

Leia Minaker, Director
Eryn Stewart, Managing Director

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Empowering the Future of Civic Intelligence
Optimizing Freshwater Delivery in Iqaluit
Rainwater harvesting in Manila
Robot module for sewer inspection with SLAM and machine learning
Mobile robot for pipe inspection
LOX-Ethanol Rocket with Thrust Vector Control
Modular e-assist for manual wheelchairs
Dynamic digital reader for the visually impaired
Urban Heat Island Detection
Reducing summer temperatures in Waterloo
Urban Greenhouse Gases and Air Quality Monitoring Networks
Transforming building assessments into climate-smart retrofits
HSC classification using a DSL & machine learning
Bone Fracture Detection with Microwaves
Wearable posture correction device
Using GenAI to forge fairer societal agreements
Health-focused multifunction drink maker
Managing E-cigarette waste in the KW Region
VR earthquake simulation for buildings
Forest fire recovery modelling
Accessible maps and route planning for campus
UW Business Process Improvements

1 Overdose Detection Device Team ODDBOX

Julia Cosma, Jennifer Tsai, Larhya Miller, Patrick Kim, Bruce Wang

As the prevalence of the opioid crisis continues to be an urgent public health matter, there is an imminent need for a solution to address the increasing toll of overdose deaths. Reports show that the majority of fatal events occur when an individual is consuming substances alone. Due to this, the use of technology in this context has been of recent interest. Upon reviewing the literature on developing technologies, further directions called for a user-centred design that incorporated stakeholder input. Through our collaboration with Sanguen Health Centre, and the support of CMC: Foundation for Change, we present a solution that is offered as a personal monitoring system that will integrate into the user's daily routine. The system is retrofitted to the standard locking medication box used in the pharmaceutical system which regulates the exchange of opioid-based treatments to the user base.

Our design focuses on developing a mechanism to detect physiological signals that can indicate the onset of an opioid overdose, including respiratory depression and blood oxygenation. To do this, we integrated, benchmarked, and validated pulse oximeter and accelerometer sensors to create a novel algorithm and system to detect high thresholds of opioid use. We tested our system for optimal placement on the body and its tolerance to different user positions. Overall, this project demonstrates a proof-of-concept, low-cost and user-centred approach to monitoring opioid substance use to inform users of any potentially fatal physiological states. We aim to move forward validating our design, while continuing to develop our partnerships with community programs, technology manufacturers in this space, and governments, for the successful implementation of our solution.

2 Bridging Gaps in Harm Reduction Through Community-Based Mentorship
Team KWMUnity

Chelsea Gagnon, Simran Bansari, Alisha Dey, Andrew Yang, Zara Kamran

Ontario's opioid crisis faces unprecedented challenges as Bill 223 necessitates the closure of 10 of 12 supervised consumption sites by March 31, 2025. This will cut off access to life-saving services for people who use drugs (PWUD) with no proposed alternative, and eliminate harm reduction options and impose abstinence only models. With the guidance of our stakeholders, Sanguen Health Centre and the Centre for Motivation and Change, we identified critical gaps in continuity of care, long-term support networks, and community stigma.

In response, this project proposes KWMUnity, a peer mentorship program for PWUD in the Kitchener-Waterloo region. KWMUnity's purpose is to bridge existing community programs to create a network that provides support during high-risk periods where the likelihood of overdose increases. Using evidence-based screening and training, mentors are recruited and equipped with harm reduction techniques, motivational interviewing, and community reinforcement approaches that foster meaningful connections and growth environments that improve health, social, and economic outcomes.

The mentorship program aims to integrate with educational resources like naloxone training programs, enhance civic engagement in harm reduction, and reduce the stigma that gives rise to isolation faced by PWUD to foster a community of understanding and support. KWMUnity seeks to build healthy, prosperous cities and communities by decreasing opioid related deaths, overdoses, and healthcare burdens. Our continued partnerships and growing network will ensure sustainability and scalability to expand beyond Kitchener-Waterloo. KWMUnity envisions a future where harm reduction is accessible, stigma is diminished in communities, and PWUD can achieve meaningful reintegration into society.

3 Micromobility Battery Fire Detection Team TITAN

Benie Matoka Mabondo,
Jessica Farias Medina,
Chaitya Ankur Patel, Devanshi Paliwal,
Maia Grace Tse,
Elizabeth Victoria Smyth

The increasing adoption of micromobility vehicles such as e-bikes has raised safety concerns about thermal runaway events from lithium-ion battery failures. Thermal runaway is a dangerous chain reaction where a battery overheats uncontrollably, potentially leading to fires or explosions. With many GO Train riders bringing their e-bikes on board during travel between cities, the risk of battery failure while on the train poses major risks for passenger safety and infrastructure. This project aims to address these risks by developing an innovative Thermal Incident Tracking and Notification (TITAN) device.

Our solution is a standalone monitoring system that is designed to be stationed near an e-bike on a bike rack on a GO Train. The system incorporates sensors including infrared cameras for thermal sensing and multi-gas sensors to continuously monitor for indicators of thermal runaway. When thresholds—established through literature review and supported by heat transfer simulations—are exceeded, the system sends an alert to train crew via a mobile app, providing real-time battery health information.

By focusing on proactive monitoring and notification, this project reduces the risk of using micromobility vehicles for GO Train passengers while supporting the sustainable adoption of electric vehicles. With the possibility to expand the usage of this safety system to multiple contexts, our solution acts as an important starting point to address emerging micromobility challenges.

4 TransitWorks: transit route optimization
Team TOVERP

Dania Hanif, Jeevan Opel,
Joshua Rayappa, Shivam Sood,
Daniel Nguyen, Tim Zhao

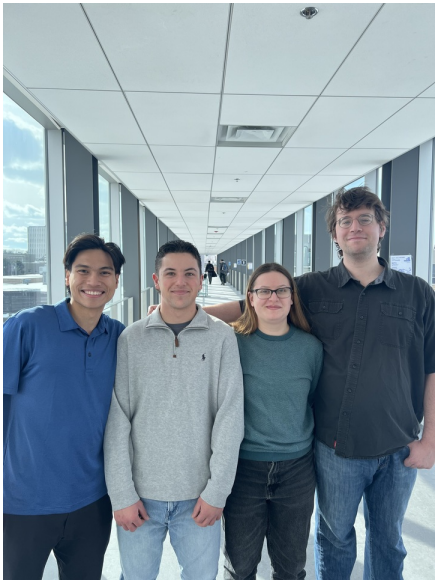
Public transit networks around many North American cities are inefficient and underutilized. One study by Statistics Canada revealed a significant disparity between travel modes in Canada, with only 1.6 million commuters using public transit regularly compared to the 13.2 million people who drive. Excessive transfers, long wait times, and other service inefficiencies are among the chief reasons cited by public transit surveys that contribute to low levels of public transit ridership.

Existing transit route planning primarily utilizes manual methods that fall short in leveraging all available data. These approaches often result in transit systems that prioritize operational convenience over passenger needs, leading to low ridership and poor service coverage.

Our open-source software utilizes publicly available data and meta-heuristic algorithms such as Ant Colony Optimization to improve existing bus networks. The system assesses data such as origin- destination demand, modal split, and land use to optimize multiple criteria. This includes reducing transfers, minimizing trip times, and improving coverage of underserved areas. Our approach focuses on incrementally improving existing routes while maintaining operational feasibility.

The software supports a range of optimization objectives, integration with real-world constraints, and built-in visualization tools. By optimizing bus routes around already existing infrastructure, we can help transit agencies to see the quickest results with minimal upfront investment. Making this tool freely available and generalizable across different regions helps transit agencies of all sizes make data-driven decisions about route modifications and balance efficiency and equity goals.

5 Paving the way for the future of Iqaluit
Team Polar Pathfinders



Rafael Llorin, Carlo Smokowich,
Sarah Knoblauch,
Matthew Andreas Schneider

The City of Iqaluit faces significant challenges with traditional asphalt paving, including dust accumulation, large potholes, undulation from freeze-thaw cycles, and high costs for implementation, maintenance, and materials shipping. This report presents a comprehensive analysis of three alternative paving solutions tailored to the extreme cold-climate conditions of Iqaluit. The proposed solutions—chip-seal, polymer modified asphalt, and a dust suppressant created by Bio Diffusion Technologies—are evaluated to assess their viability, efficacy, and sustainability in the Northern region. Each alternative is assessed for its ability to improve upon current road surfaces (asphalt, gravel roads) in durability, reduce shipping, labour, and maintenance costs, and address the unique challenges posed by Arctic environments. Disadvantages of each solution are also highlighted, enabling the City of Iqaluit to make informed decisions aligned with its priorities for infrastructure development. The analysis draws on case studies of successful implementations in other Northern Arctic regions, including Alaska, Yukon, and the Northwest Territories. By examining the performance and adaptation strategies, the report provides insights into how these solutions could be effectively applied in Iqaluit. This evaluation seeks to guide the City of Iqaluit in identifying the most feasible and cost-effective paving solutions for potential future adoption. By focusing on long-term improvements in road infrastructure durability, efficiency, and economic viability, the report emphasizes sustainable approaches tailored to Iqaluit's unique Arctic environment. These solutions aim to reduce costs, enhance efficiency, and support the development of resilient and sustainable road infrastructure, ensuring long-term benefits for the community.

6 Automating Pothole Detection & Reporting
Team Asphalt Avengers

Liam McArdle, Connor Bechthold, Rishit Daru, Safwaan Chowdhury

Potholes pose significant risks to public safety, causing vehicle damage, accidents, and contributing to higher repair costs. Traditionally, cities and municipalities rely on crowdsourced reporting through online forms and hotlines, which can be inconsistent and unreliable. While more accurate detection methods, such as LiDAR-equipped sensor vehicles, are available, their high cost often makes them impractical for widespread use.

Our pothole detection system bridges the gap between accuracy and affordability by leveraging advanced computer vision and machine learning. Municipal workers can easily attach a camera and Raspberry Pi module to their vehicles, which will continuously capture and analyze road conditions for potholes. The system is powered by a YOLOv5 object detection model, trained on a diverse dataset of pothole images across various climates and environments, enabling robust detection in different conditions. Once potholes are detected, the system automatically uploads images, along with GPS coordinates, to a centralized database. This data is then displayed on a user-friendly web application, allowing municipal officials to efficiently review and address road issues.

By automating pothole detection and streamlining reporting, municipalities can proactively manage road damage, reduce vehicle repair costs, and optimize resource allocation. This innovative solution has the potential to transform urban infrastructure management, improving public safety, reducing repair costs, and fostering more sustainable, well-maintained transportation networks. Offering an affordable, effective alternative to traditional methods, it has the potential to revolutionize the way cities manage their roads, paving the way for safer, more reliable infrastructure.

7 Investigating electric fire trucks for Kitchener Team Spark-e

Melissa Valad, Nick Algeo

This project investigates the feasibility of electrifying the City of Kitchener's fire fleet to align with municipal climate action goals to reduce greenhouse gas emissions. The study focuses on analyzing the operational, financial, and environmental implications of phasing in electric fire trucks. By conducting a comprehensive fleet analysis and engaging with stakeholders, we evaluate the compatibility of electric fire trucks with the city's emergency response needs.

The research draws on insights from leading manufacturers of electric fire apparatuses, including their technological advancements and limitations, and examines pilot programs from cities like Brampton and Vancouver to learn how electric fire trucks perform in the field. In addition to operational considerations, the project assesses the financial viability of fire fleet electrification by collecting the costs of procurement, charger installation, and operation and contrasting them with the long-term maintenance savings. Environmental benefits, such as reductions in emissions and improvements in air quality, are also quantified to highlight the broader community aspects of this transition.

The findings aim to provide city decision-makers with actionable recommendations for implementing a sustainable and reliable fire fleet to meet their Net Zero strategy set forth in the City of Kitchener's Corporate Climate Action Plan. By balancing environmental goals with emergency service performance requirements, this study supports Kitchener's desire for municipal sustainability while ensuring the safety and well-being of its residents.

8 Iqaluit Municipal Asset Management Team Northern Assets

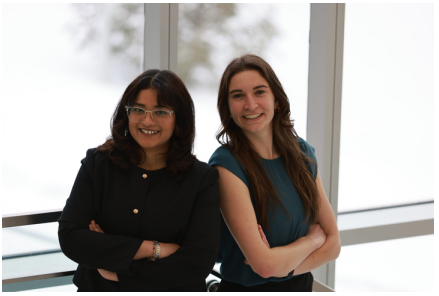
Lucas Yurcich, Ao Shen, Katie Burt

The Municipal Asset Management problem that the City of Iqaluit is currently facing stems from an inability to integrate modern, efficient solutions that enhance uptime and operational efficiency within the municipality. These assets range from pickup trucks and community centres to streetlights and sewage treatment plants. The existing processes are either outdated or entirely absent. For example, the city currently lacks a system to monitor and schedule maintenance for pickup trucks, which can result in unexpected failures and higher repair costs.

Our project proposes a smart asset management solution that integrates mobile assets with the city's financial software. By leveraging AI-driven predictive maintenance, the system will track usage of vehicle parts and automate part ordering based on usage patterns, reducing unplanned downtime and optimizing resource allocation.

In addition to mobile assets, we are developing a scalable strategy to improve the management of other municipal infrastructure, including recreational centres and public utilities. Our symposium deliverable will outline the implementation roadmap, cost structure, potential roadblocks, and strategies for overcoming these challenges. This initiative aims to improve operational efficiency, promote data-driven decision-making, and establish a foundation for modernized municipal asset management in the City of Iqaluit—setting a precedent for future city innovations.

9 Sustainability in STEM education
Team The SILO Project



Sogra Fathima, Solina Quinton

As society advances, sustainability in education is becoming increasingly essential. Despite the rising need to address sustainability, a system to teach this in elementary education has not yet been implemented. There is a need to do this in an engaging and interactive format that best inspires the students to take on these challenges with a creative approach to problem solving.

The SILO Project offers a solution to this inevitable challenge. Developed as a resource intended to target the integration of STEM education in Australian primary school classrooms, the SILO Project outlines detailed lessons that can be used by educators to inspire students in their STEM learning. By transferring this content to the Ontario curriculum, the project can be expanded to address the lack of seamless connection between STEM and sustainability.

The first primary goal of this project is to identify gaps between existing content within the Australian SILO Project and the Ontario curriculum. The second goal is to create innovative lesson plans that address these gaps, while incorporating a theme of sustainability through a narrative element. These lesson plans will be developed through extensive research, educator feedback, and pilot testing in classrooms. Through analysing qualitative data and building on existing practices, the mission of linking narrative teaching, sustainability concepts, and STEM education will be accomplished, inspiring students to adopt a futuristic approach to learning.

10 SOS: Sustainability Office Support Team Explorers of Tomorrow

Erika MacDonald, Natalia Extavour, Hanna Elizondo, Izzie Kelly, Emma LeCouffe

The Sustainability Office (SO) is the centre of sustainability efforts at the University of Waterloo. Yet a 2024 survey conducted by the office found that 30% of respondents were unaware of it, and 25% had never engaged with its initiatives. Low engagement with campus sustainability initiatives is a pressing issue as the university has failed to meet its 60% waste diversion goal by 2025 - currently sitting at less than 30%.

Our research explores how in-person events can be optimized for student engagement. We held a one-day event in the Student Life Centre to test the effectiveness of several promotional approaches (social media and posters) and gamified learning activities. An attendee questionnaire assessed the reach of the promotional strategies, the effectiveness of gamified activities to engage and inform students, and the current barriers students face in engaging with SO initiatives.

Our results indicate that the SO should:

- Host low-commitment events and use widely followed social media channels to advertise SO initiatives, as the main barriers preventing students from engaging are lack of time, lack of awareness, and the perception that participation requires too much effort.
- Host events in high traffic areas, as traditional promotional methods, such as physical posters and Instagram advertising, were less effective at driving event attendance compared to chance encounter.
- Incorporate gamified activities at their events, as students preferred these over traditional information-based booths.
- Prioritize engaging students outside the Faculty of Environment, as students outside of Environment experienced the greatest improvement in understanding of SO initiatives.

11 Automation for Iqaluit Development Reviews Team Iqaluit Insider Plan

Vedhant Sarma, Furogh Abidi, Ivena Yeung

The City of Iqaluit faces challenges keeping up with reviewing and approving proposed developments within their jurisdiction and maintaining an authoritative source for planning and development policies and bylaws. These constraints increase the risk of human error in the development review process and slow down the pace of economic development in Iqaluit.

In response to this, our team proposes a tool that will increase the efficiency in the development review process and offer the City of Iqaluit an improved information governance structure. Our tool will provide a user-friendly GIS-based interface that allows planners to view and update policies relevant to proposed developments. When a development application is submitted to the City of Iqaluit, the planner can input the geographic location and type of development. Our tool will then display the applicable rules and bylaws. This allows the planner to confirm that the development is in compliance with Iqaluit's bylaws and policies without reviewing numerous technical documents in search of the current and accurate policies.

While our project is being developed in partnership with the City of Iqaluit, we aim to make our tool accessible to developers, though without editing privileges. This will give developers a single updated plain-language source for Iqaluit's development-related policies and bylaws and minimize back-and-forth between planner and developer

12 Developing a sustainability roadmap for Moncton Industrial Development
Team LEED Ready

Karen Kalra, Prayan Jegathees

Moncton Industrial Development (MID) is an industrial real estate developer that acquires, prepares, and sells land to businesses. As sustainability becomes a key priority for industries, MID seeks to align its land development strategy with market demands for environmental reform while maintaining its core business model. The project proposal outlines a practical approach to sustainability minimally invasive to current business practices, targeting LEED alignment, clean energy grid expansion, and financial grants and incentives supporting green development projects. By implementing these measures at the land development stage, MID enables businesses to pursue sustainability while minimizing disruption to its own operations. This approach allows MID to capitalize on emerging market trends without significant capital investment or deviating from its established business model.

By integrating Leadership in Energy and Environmental Design (LEED) standards, MID can market its properties as 'LEED-Ready' – providing businesses with land that supports their sustainability goals without requiring them to make costly modifications. This strategy strengthens MID's competitive positioning, attracts environmentally conscious clients, and enhances its public image as a forward-thinking developer.

Additionally, by leveraging government incentives for sustainable development, MID can reduce costs while reinforcing its commitment to responsible growth. This positions the company as a leader in sustainable industrial real estate, aligning with industries transitioning toward electrification and carbon reduction.

By facilitating rather than enforcing sustainability, MID creates a profitable and practical pathway to environmental responsibility, ensuring long-term business viability while meeting the expectations of an evolving market.

13 Empowering the Future of Civic Intelligence
Team Illume

Shane Hsieh, Ryan Chan, Adam Lam

Municipal staff face critical challenges in the analysis of civic engagement data, dealing with a manual and resource-intensive process that fails to adequately leverage technological advancements. In alignment with the United Nations' call for Sustainable Cities and Communities (SDG 11) and Peace, Justice, and Strong Institutions (SDG 16), Illume seeks to contribute to these goals by promoting transparent and inclusive decision-making.

Illume is a web application that transforms the complexity of civic engagement data into clarity, empowering users to make informed decisions with confidence. Existing digital tools are often overwhelming—they are complex and opaque, leaving users unable to explain and trust where the results are coming from. In civic engagement, where public trust in the decision-making process is paramount, this lack of transparency worsens the problem.

Illume changes that. The first key feature is thematic analysis, a well-established evaluation method, that buckets data into different themes. This helps the user to quickly evaluate their dataset. The second key feature is integrating a human-in-the-loop process, incorporating the unique human expertise and contextual awareness of the user to then accept or reject the given classification. In the end, this creates a high quality, ground truth dataset that can be used for further analysis. With this process, users can feel confident and be able to articulate how they used Illume in their work.

Ultimately, Illume synergizes evolving technology, trustworthy principles, and human expertise to empower the future of civic intelligence through informed and inclusive civic engagement.

14 Optimizing Freshwater Delivery in Iqaluit
Team WaterHive

Roger Chan, Karen Eng, Ken Luong, Grace Zhang

Iqaluit, the capital of Nunavut, faces unique challenges in freshwater delivery due to its extreme Arctic climate, which makes conventional underground piping systems impossible. Residents rely on water trucks to fill household water tanks, but the current system often results in inconsistent delivery and unexpected water shortages, leading to costly after-hours emergency fill-ups, increasing expenses for both residents and the municipality.

This project proposes a mobile app solution to improve delivery and reduce the occurrences of residents running out of water. The solution consists of three components:

1. A mobile application that enables residents to place ad hoc water delivery requests and track their water tank levels in real time.

2. A tank monitoring device, installed in home water tanks, which continuously measures water levels and transmits the data directly to the service provider through a wireless connection. This ensures both the resident and the water delivery service have up-to-date information about tank status.

3. Predictive analytics using the collected water usage data to proactively plan deliveries before tanks run low. This helps prevent emergency situations and allows for more efficient route planning, reducing strain on the system.

By developing a robust mobile app for residents and integrating it with real-time sensor data and intelligent scheduling, this solution streamlines the freshwater delivery process. The goal is to enhance communication between residents and water delivery services, minimize emergency fill-up requests, and ensure a reliable supply of freshwater—improving quality of life for Iqaluit.

15 Rainwater harvesting in Manila
Team Rain

Our project tackles the lack of reliable drinking water in underserved communities, especially in tropical wet climates like the underserved communities of Manila, Philippines, where outdated infrastructure and waterborne diseases cause serious health problems. In the Philippines, at least 14 people die daily from waterborne illnesses.caused by waterborne pathogens such as E. coli and Giardia which can cause dehydration, and often to a fatal level if left untreated. Many communities also face complete water shortages due to poor resource management and increasing demand.

Ian Rajkumar, Misk Al-Barrak, Sean Raviv Vaserman

Our goal is to reduce the reliance on subpar infrastructure by creating an independently functional harvesting and filtration system which will provide water in lieu of the existing infrastructure. Our system will collect, store, and filter rainwater using modernized filtration strategies, combined with modular technology. It is designed for areas with 1800–2500mm of annual rainfall and can serve 3–4 households (up to 30 people). It includes storage tanks, advanced filtration to remove contaminants, and potential options for off-grid power sources like solar panels or manual pumps. The filtered water will be used solely for drinking to ensure maximum availability. The modular design allows customization for specific local needs, such as filtering contaminants present in the region. This makes the system easier to assemble while remaining cost-effective. We hope that in the future, our system will become the status quo in tropical regions. Using our system will not only be beneficial to communities, but it will also decrease the overall usage levels of the centralized water systems, which will be a source of relief on a system which is already excessively used. By providing a sustainable, adaptable solution, our system will enrich communities, provide a sense of comfort and assurance to vulnerable populations, and will also benefit municipalities and other governing bodies by diverting water back to them to be used for other beneficial processes, resulting in short and long term positive impacts for all stakeholders.

16 Robot module for sewer inspection with SLAM and machine learning
Team RoboNav

Liam Senych, Araf Khan,
Anirudh Kilambi, Youngwoo Lee

Inspecting sewers is dangerous, dirty, and difficult. Sewer lines are a major piece of infrastructure for cities; failure to ensure their safe operation can lead to ecosystem damage and public health concerns.

This capstone project introduces a plug-in robot module containing a suite of sensors designed for non-destructive testing of sewer pipes. By utilizing a 3D-LiDAR sensor and a stereo camera, the module implements Simultaneous Localization and Mapping (SLAM) as the solution to the challenge of poor navigation and mapping within GPS-denied, low-light, featureless environments. The robot's location within the generated map is displayed in real-time, along with any detected defects. This enables precise navigation compared to encoder-based methods.

This module, which interfaces directly to the robot's ROS2 framework, communicates to a custom front-end interface via a node.js intermediary server. The front-end Electron.js-based application displays vital information including a real-time camera feed paired with a real-time YOLOv11 machine vision model to detect defects such as cracks, corrosion, and obstructions, reducing reliance on manual defect identification. This automated approach improves testing efficiency and reduces the likelihood of human error. The application also handles robot controls and a 3D visualization of the LiDAR point cloud.

The impact of this project extends to providing municipalities with a scalable, cost-effective solution for proactive monitoring and accurate defect locating. By detecting issues early, the module helps prevent catastrophic failures, saving time, money, and resources. Ultimately, this robotic module enhances the sustainability, safety, and longevity of urban sewer infrastructure, contributing to more resilient and efficient city systems.

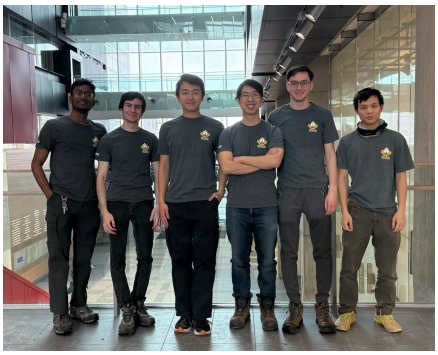
17 Mobile robot for pipe inspection
Team Inspector Gadget

Varun Shroff, Suhayl Sayed, Saawan Patel, Shammo Saha

Detecting anomalies in pipelines, HVAC systems, and industrial ducts is often costly and inefficient, typically requiring disruptive manual inspections or expensive specialized equipment. Inspector Gadget solves this problem with a compact, autonomous robot designed to inspect pipes ranging from 8 to 48 inches in diameter, filling a critical gap in smaller pipe inspections. With real-time 3D mapping, autonomous crack detection, and a lightweight, water-resistant design, it delivers precise, non-invasive inspections. Our custom machine learning and point cloud algorithms ensure adaptability across materials such as sheet metal, copper, steel, concrete, and PVC, making Inspector Gadget a versatile solution for oil, sewage systems, HVAC maintenance, and industrial infrastructure monitoring.

Equipped with an OAK-D stereo camera, it performs real-time crack detection and point cloud generation via photogrammetry, eliminating the need for LiDAR. While optimized for circular pipes and ducts, our photogrammetry algorithm can be adapted for rectangular and irregular geometries, extending its applicability to rectangular HVAC ducts and non-standard industrial piping. The YOLOv11-based model accurately detects cracks and defects, with adaptability to diverse datasets for varied materials and environments. A Raspberry Pi-powered system enables user navigation through ROS, while a PySide6-based Linux application provides real-time monitoring and a 3D point cloud viewer for data-driven decision-making. The mechanical design consists of durable, water-resistant 3D-printed PETG housing and TPU tracks for superior traction. Inspector Gadget delivers a versatile, high-accuracy inspection tool with a total parts cost under $500, a fraction of current solutions, while enhancing infrastructure monitoring and reducing failure risks and environmental damage.

18 LOX-Ethanol Rocket with Thrust Vector Control Team Hoppers



Kavin Satheeskumar,
Jack Christensen, Francis Yao,
Michael Zhou, Nahvid Zolfaghari,
Rio Liu

The commercialization of rocket launches in recent years has significantly reduced the cost of space access. A major factor in the decrease of the cost of launches comes from the ability to land and reuse rocket boosters. We believe that developing the technologies required to propulsively land rocket stages domestically will enable increased access to space from Canada.

The primary goal of this project is to develop and test a non-flight rocket engine using liquid oxygen, a cryogenic oxidizer, and ethanol fuel. We have chosen a copper combustion chamber to act as a heatsink, allowing for a targeted 10 second burn time without a complicated cooling systems. The engine is capable of gimballing using Thrust Vector Control (TVC), meaning it can precisely point the direction of thrust while firing to control a rocket stage when it is launching or descending to a landing pad. Supporting these are a custom cryogenic fluid feed system and control algorithm for precise engine position control.

In the future, capstones and members of the Waterloo Rocketry team will be able to build off of our work such as with thrust throttling, regenerative cooling and eventually a full flight vehicle. Our project will help develop the expertise of these technologies domestically in Canada and contribute to the following United Nations Sustainable Development goals: Industry, Innovation and Infrastructure, Responsible Consumption and Production, and Quality Education.

We would like to thank Dan Steinhaur of Stein Industries Inc., Samco Machinery Ltd. and the Waterloo Rocketry student design team for their contributions in equipment and funding towards this project.

19 Modular e-assist for manual wheelchairs
Team Vroom Vroom Wheelchair

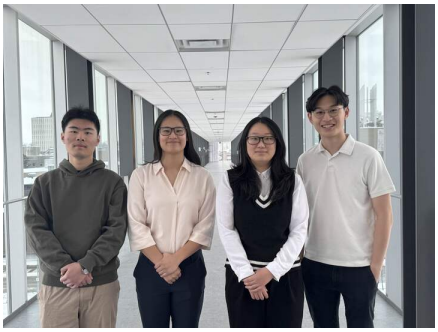
Vroom Vroom Wheelchair has developed an innovative retrofit attachment for manual wheelchairs that enhances mobility through an assistive motor system. This system is designed to reduce the physical effort required to operate manual wheelchairs, improving accessibility for users with limited upper-body strength.

Hardit Sabharwal, Peter Ra, Nafis Molla, Ambuj Ranjan, Girisankar Solaimalai

Unlike existing powered wheelchairs, the solution is lightweight, compact, and fully detachable, ensuring compatibility with a wide range of manual wheelchair models. This solution is specifically designed to be compatible with most standard hospital wheelchairs, offering a universal fitting system that can be installed without permanent modifications to the base wheelchair. The modular design also ensures portability, allowing users to maintain the practicality of manual wheelchairs for transport and everyday activities.

The user interface has been optimized to resonate with the natural action of moving a manual wheelchair, thereby ensuring intuitive control of the system. This solution represents a significant step forward in making powered mobility assistance accessible to a broader population.

20 Dynamic digital reader for the visually impaired
Team eyePad



Alan Su, Carita Chung, Jennifer Yan, Brian Fu

The project aims to address the lack of resources available to aid the visually impaired in the education setting. Despite the rise of modern technology with AI and text-to-speech, there remains a gap for the visually impaired to reach their full potential. A graphical touch display that communicates through visuals, whether that be graphs, diagrams, or math would allow educators to better convey concepts to visually impaired students. A study from the Journal of Blindness Innovation and Research shows that 82% of youth report having trouble accessing information in the classroom for math and science content.

These subjects rely heavily on visual elements, such as geometry, pattern recognition, data visualization, and objects in three-dimensional space to learn the material faster and better grasp concepts. Limited access to STEM resources in academics discourages visually impaired students from pursuing STEM careers, hampering higher education and employment opportunities. Existing assistive technologies fall short in providing interactive and graphical representations. A graphical touch display tool that helps with the visualization process would make STEM education more enjoyable, building an inclusive classroom, where students regardless of their vision impairment have the opportunity to participate and be successful.

21 Urban Heat Island Detection Team HEAT

Emma Runtian Wang, Sabrina Lee, Muiz Ur Rehman, Tong Yin Han, Christine Ng

Densely populated Canadian cities are increasingly experiencing the urban heat island (UHI) effect due to climate change, posing risks to public health, energy consumption, and overall urban livability. Urban planners, policymakers, and public health researchers need accurate, high-resolution data to identify heat-prone areas and the underlying factors contributing to extreme heat. Existing solutions primarily rely on satellite imagery, which provides aggregate heat data but lacks the granularity needed for practical urban planning. Without time series data, such as hourly temperature fluctuations or seasonal trends, it is difficult to monitor how UHIs evolve in response to infrastructure changes or natural variations.

To address these gaps, we introduce HEAT, a mountable sensor network that collects real - feel temperature data along with tree canopy coverage to better understand heat distribution in urban environments. The system continuously gathers localized temperature readings, allowing for the generation of time series datasets that reveal patterns in urban heat dynamics. This data can be integrated with ArcGIS to create interactive heat maps, providing insights into hot and cool zones and identifying specific infrastructure, surfaces, or vegetation contributing to temperature variations. HEAT is designed as a sustainable solution, powered by solar energy, ensuring long-term usability with minimal maintenance. By offering a scalable and data-driven approach to urban heat monitoring, HEAT equips decision-makers with the tools needed to develop targeted cooling strategies, optimize green infrastructure placement, and create more climate-resilient cities.

22 Reducing summer temperatures in Waterloo
Team Urban Heat Deflectors

Dante Duval, Tanvi Patel, Marcus Chan

Urban heat is a growing global challenge, exacerbating public health risks and increasing thermal discomfort. Areas such as Conestoga Mall and Waterloo Public Square in the City of Waterloo face similar challenges, particularly during the summer. The urban heat island (UHI) effect worsen temperature disparities between urban and rural areas due to concrete surfaces and increased human activity. Targeting these hotspots, this project will focus on recommendations of passive cooling solutions to the city, aiming to improve thermal comfort, sustainability, and climate resilience.

Recommendations of passive cooling strategies would include green roofs, green walls, cool pavements, and reflective materials. Green roofs serve as a multi-functional solution, reducing heat through insulation and evapotranspiration while also enhancing biodiversity and stormwater management. Cool pavements minimize heat absorption and radiation by employing high-albedo materials, contributing to a cooler microclimate. Reflective materials, when integrated into building design and infrastructure, effectively deflect solar radiation, further reducing heat buildup.

Using an interdisciplinary approach, this study will assess the feasibility, cost-effectiveness, and scalability of these solutions within Waterloo's urban landscape. Data from case studies, climate modelling, and community input will be used to identify optimal implementation strategies. The outcomes of this research will provide actionable insights for urban planners, policymakers, and stakeholders in Waterloo and similar cities, showing how passive cooling strategies can alleviate urban heat, enhance quality of life, and foster sustainable urban development in the face of climate change.

23 Urban Greenhouse Gases and Air Quality Monitoring Networks
Team The Emission Mission

Tanveer Singh,
Erin Schmidt (supervisor),
Chanpakorn Chaiklahan, Yuan Yuan,
Rafay Hassan Chishty

Cities in Ontario currently face challenges in monitoring greenhouse gases (GHGs) and particulate matter (PM) at a localized level. GHG emissions are typically estimated using inventory systems, and air quality data is gathered from a limited number of monitoring stations and sensors, which restricts the ability to identify specific pollution sources and implement targeted mitigation strategies.

A potential solution is the deployment of a sensor network that combines a few expensive sensors to measure CO_2 with several affordable sensors dedicated to detecting PM and other gases. This approach could address the issue of localized monitoring. The goal of this project is to evaluate the feasibility of using affordable air monitoring sensors, connected in a network, while maintaining accuracy and reliability similar to current methods for tracking GHG emissions.

We deployed the sensor network, consisting of one reference sensor that measures both CO_2 and other pollutants, and four PM sensors across the University of Waterloo campus. We then compared the results with data from the Kitchener air monitoring station. The network showed promising results, exhibiting similar pollution trends while capturing variations due to local environmental factors. Based on these findings, we aim to expand the project, propose it to municipalities, and offer a viable solution for real-time emissions monitoring, supporting data-driven decision-making.

24 Transforming building assessments into climate-smart retrofits
Team RetrofitGPT

Yuanao Wang, Junyi Chen,
Arjun Krishna, Eugene Sim,
Aaditya Rastogi, Andrew Feng Jia

Commercial buildings face increasing risks from climate change, yet decision-making around resilience and efficiency improvements is often hindered. Without clear, actionable insights, building owners struggle to implement effective retrofit strategies that balance risk mitigation with financial viability. RetrofitGPT looks to use Generative AI to simplify and streamline the analysis of Building Condition Assessments.

By organizing data like material types, structural components, and maintenance histories, this project, in collaboration with RBC, looks to transform unstructured reports into actionable retrofit recommendations. Combining this information with climate projections and geospatial data, it identifies vulnerabilities and calculates potential impacts. The system then suggests tailored retrofit measures designed to improve the resilience of the building and maximize return on investment.

A focus on return on investment ensures that recommended interventions are both cost-effective and impactful. A decision-support platform combines these elements, integrating risk assessment, financial analysis, and climate forecasting to help stakeholders make informed choices. This measured approach not only strengthens infrastructure and protects property values but also supports broader goals of reducing environmental impact and meeting regulatory expectations. By offering a data-driven framework, the project ultimately aims to empower stakeholders to make informed decisions that enhance climate resilience and offer a financial incentive.

25 HSC classification using a DSL & machine learning
Team Stemmy

Hematopoietic stem cells (HSCs) are rare tissue stem cells defined by both a capacity for self-renewal and ability to differentiate into all blood cell types; sustaining lifelong blood production.[1] Bioimage analysis is a powerful tool for HSC scientists to measure fluorescence intensity density (IntDen) of known HSC biomarkers (TFEB, LAMP1, and CDK6) and quantitatively assess HSC stemness.[2,3] For studying HSC biology, the bioimage analysis tool ImageJ demonstrates some insufficiencies.

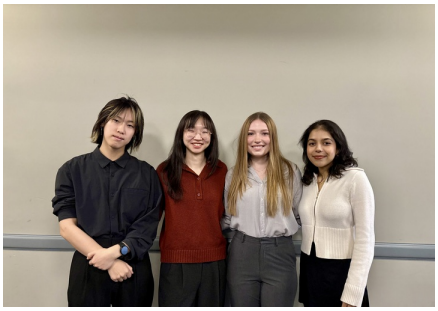
Veronika Sustrova, Katarina Makivic, Isabella Di Biasio

The existing HSC image analysis pipeline involving ImageJ is laborious for scientists, and presents many opportunities for automation. Current approaches for assessing HSC stemness rely on scripts written by the user as well as the manual extraction and analysis of data for hundreds to thousands of images per dataset. To address these challenges, we propose an enhancement to the current image analysis workflow to improve the productivity and user experience of stem cell biologists for HSC image analysis. Our approach involves the development of a domain-specific language (DSL) to alleviate the particularities associated with writing a script in the ImageJ Macro language. Additionally, we are focusing on the implementation of a machine learning algorithm capable of classifying cells as HSC based on the IntDen of aforementioned biomarkers, abstracting the user from sifting through large amounts of data to draw meaningful conclusions.

In collaboration with researchers at the Princess Margaret Cancer Centre, we integrated task-oriented design and prioritized user experience in the bioimage analysis workflow. Our solution seeks to optimize the HSC classification process and facilitate the productivity of HSC research for clinical translation.

1. Laurenti, E & Gottgins, B. From hematopoietic stem cells to complex differentiation landscapes. Nature. 553, 418-426 (2018).
2. Garcia-Prat, L., et al. TFEB-mediated endolysosomal activity controls human hematopoietic stem cell fate. Cell Stem Cell. 28, 1838-1850 (2021).
3. Laurenti, E., CDK6 levels regulate quiescence exit in human hematopoietic stem cells. Cell Stem Cell. 16, 302-313 (2015).

26 Bone Fracture Detection with Microwaves
Team Pro-Bone-O



MinYoung Park, Adora Dong,
Victoria Isabelle Purcell,
Vithusha (Metha) Tharmarasa

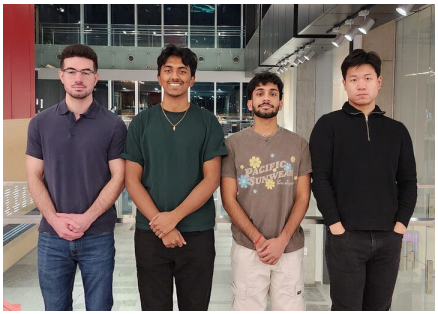
Access to diagnostic medical devices such as X-ray machines remains a significant challenge in remote and Northern communities in Canada due to cost, size, and reliance on specialized facilities and operators.

Pro-Bone-O is investigating a novel bone fracture screening method using low-frequency microwaves paired with machine learning. This approach is fast, portable, safe, and accessible, aiming to provide reliable fracture screening without the need for hospital infrastructure.

Our research combines simulations with experimental testing to evaluate the viability of this technology. Using electromagnetic simulation software, we simulate the interaction of low-frequency microwaves with various bone structures, collecting S-parameter data from different antenna types and frequencies. In real-world experiments, animal bones are encased in tissue-like phantoms to replicate human anatomy. Data collected from both simulations and experiments are processed through a deep neural network to assess accuracy in fracture detection and classification.

This study will determine how accurately this method can identify and differentiate bone fractures, assess the reliability of microwave imaging for medical applications, and identify optimal frequencies and antenna configurations. This technology could be used in remote clinics, emergency room waiting areas, nursing homes, ambulances, and other locations where quick bone fracture screening is critical. Through developing this method, we aim to create a safe and portable preliminary screening tool for bone fractures, providing essential diagnostic tools to underserved and remote communities.

27 Wearable posture correction device
Team BackTrack



Zia Formuly, Rishi Sarkar,
Sanju Sathiyamoorthy, Chris Jiang

Our project introduces a wearable posture correction device designed to help individuals maintain proper posture and assist physiotherapists in managing posture-related issues. This device features advanced spine tracking, an integrated app for real-time feedback, and customizable goals tailored to each user's progress. Unlike generic fitness trackers, this system is specifically focused on improving posture, targeting individuals who experience poor posture due to sedentary lifestyles, athletes, or those with chronic musculoskeletal conditions such as back pain or scoliosis.

The device is especially beneficial for office workers, athletes, and individuals undergoing rehabilitation, as it not only supports the correction of misalignments but also enhances patient education and encourages adherence to corrective practices. By providing real-time data and actionable insights, it helps physiotherapists remotely monitor patient progress, optimizing treatment and rehabilitation plans. This leads to more efficient use of time and resources, reducing the need for frequent in-person visits while improving long-term outcomes for patients.

With its easy-to-use, comfortable design, this wearable solution empowers users to proactively manage their posture throughout the day, preventing injuries and promoting overall musculoskeletal health. Whether used for chronic condition management, post-injury recovery, or daily posture improvement, this device offers a convenient, data-driven approach to postural correction, ensuring sustained benefits for both individuals and healthcare professionals alike.

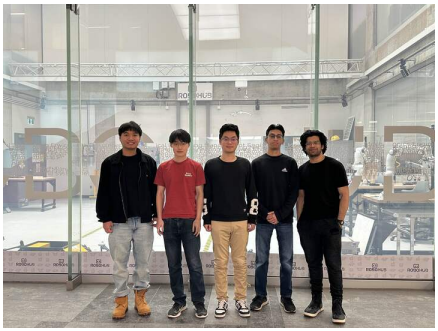
28 Using GenAI to forge fairer societal agreements Team Fairplay

Raewyn Tsai, Salone Verma, Jenny Tai

John Rawls' theory of justice as fairness remains a pivotal framework in understanding societal contracts and the fair administration of justice. While highly influential, key concepts from Rawls' framework for comparative justice, such as the original position and the veil of ignorance, the difference principle, equal liberty and opportunity, and moral alignment between agents and their society have proven difficult to realize in practice. In this paper, we present FairPlay, a novel approach that uses Generative Artificial Intelligence (GenAI) agents to forge fairer societal agreements in full compliance with Rawls' requirements. To assess the performance of FairPlay, we analyze and evaluate prenuptial agreements. Our results show that FairPlay is able to recognize and address injustice in human made agreements, and propose reasonable mitigation measures to produce fairer contracts. We discuss possible extensions beyond prenuptial agreements, such as lease agreements, terms and conditions, etc. While far from a standalone tool, and liable to the same vulnerabilities that a human lawyer is exposed to, such as deception or non disclosure of key information, we believe that FairPlay has the potential to revolutionize the way that agreements are made and enforced in society, reduce systematic inequalities in the access to quality legal advise, and to ultimately help realize Rawls' vision of a fairer society.

29 Health-focused multifunction drink maker
Team VarietyVendings

VarietyVendings aims to tackle the public health concerns over sugary drinks by providing a cleaner and more transparent alternative. At the current moment, there is a lack of versatile, user-friendly home beverage systems that can cater to diverse dietary preferences. As well, added sugar content in store bought drinks is an active topic of discussion in public health.



Andrew Nguyen, Kevin Ma, Haoran Qin, Taha Shaikh, Nathan Rozario

The goal of our drink mixer is to give control to the user, allowing them to substitute store bought drinks with fine control over the added amount of sugar, caffeine, and other supplements. We aim to help people reach health standards and personal dietary needs, such as calorie requirements and dietary restrictions, while also tackling the environmental impact of disposable beverage containers. There is a lack of an eco-friendly way for the public to enjoy the drinks/brands they like, without contributing to a large sum of plastic and manufacturing waste from mass produced cans and bottles. It is estimated that over 480 billion plastic drinking bottles were sold in 2018 alone, according to Statista. Unfortunately, only about 9% of plastic waste ever produced has been recycled, with the vast majority ending up in landfills or as litter. Our goal is to develop a multifunctional drink mixer that addresses these consumer needs by integrating a variety of different drinks, customizable settings, and user-friendly interfaces into one efficient device

30 Managing E-cigarette waste in the KW Region Team InnoVape

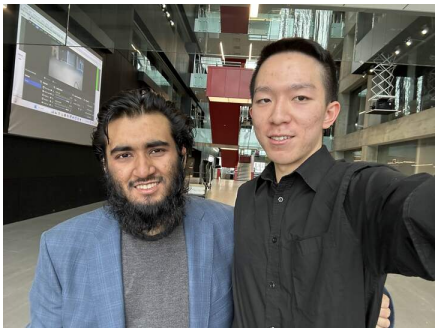
Maya Wei, Sakeenah Ashique

This research addresses the gap in environmentally conscious disposal systems for e- cigarette waste in the KW region. E-cigarettes are hazardous items, consisting of lithium-ion batteries, metal, rubber, cotton and plastic. To further understand the waste, the social, legislative and environmental impacts of e-cigarettes were analyzed. Solid waste data from a lifecycle analysis of e-cigarette manufacturing and distribution was conducted, and although data on consumption and direct impacts is limited, we conducted a survey to understand the habits of disposal and consumption among students. Our solution proposes a deposit-return system with drop-off sites to ensure a proper recycling system, reducing the environmental impact of e- cigarette waste.

We validated this proposed system by modeling it after Ontario's bottle return program, which encourages users to return their devices for monetary compensation. We also recommend drop-off locations in vape shops to ensure easy disposal and extended producer responsibility (EPR) to ensure manufacturers are accountable for the end-of-life management of their products. Drawing from successful e-cigarette recycling programs in Quebec and the alcohol industry's systems, we believe creating a similar infrastructure in the KW region is both feasible and effective.

Our goal is to establish a sustainable e-cigarette waste management system in the KW region. By implementing these solutions, we aim to reduce environmental harm, increase recycling rates, and promote local economic growth, aligning with SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production) and can serve as a model for other regions to address e-cigarette waste.

31 VR earthquake simulation for buildings
Team VirtuArch



Adnan Sarwar, Benjamin Luo

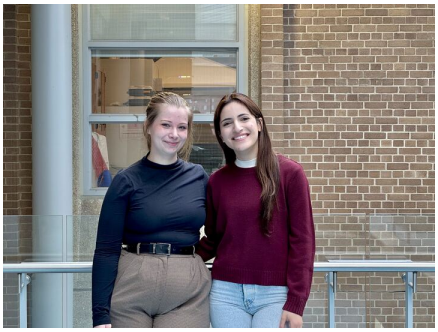
This project presents a virtual reality (VR) application for simulating earthquake-induced object movements—such as falling, sliding, and tilting—within built environments. Traditional seismic modeling spans from fast but oversimplified heuristics to computationally intensive finite element analysis (FEA). We adopt a rigid body mechanics approach as a middle ground, capturing realistic behavior while maintaining an interactive frame rate (e.g., $\geq$ 72 FPS) for a smooth VR experience.

Users can upload custom 3D models (e.g., furniture, structural components) and assign physical properties like mass, friction etc. Adjusting seismic parameters in real time (magnitude, frequency, duration) triggers dynamic interactions in the virtual environment, offering an immersive spatial visualization of potential hazards.

To support collaborative analysis, the platform integrates multiplayer sessions, enabling engineers, architects, and educators to jointly manipulate and observe objects. Built-in voice communication and real-time observation modes allow seamless participation on both VR headsets and standard PCs, bridging technical and non-technical stakeholders.

By optimizing physics calculations within the constraints of commercial VR hardware, our system provides a scalable alternative to FEA. While high-fidelity simulations can offer more granular detail, their computational demands exceed the real-time requirements of immersive VR. In contrast, rigid body mechanics runs in milliseconds per frame, delivering an effective compromise for early-stage risk assessment, educational outreach, and conceptual design. This VR-based approach thus advances earthquake preparedness by making seismic effects more accessible, interactive, and collaboratively interpretable.

32 Forest fire recovery modelling
Team Phoenix



Charlotte Hamilton, Raghad Asfour

Natural disasters have devastating impacts on the physical infrastructure, economic prosperity, and social connections of affected communities, highlighting the importance of effective recovery management. Policymakers, humanitarian organizations, insurance companies, and other experts rely on data from past disasters to anticipate the outcomes of future disasters and design relief programs to improve recovery outcomes. However, current disaster impact models were created with limited data and lack benchmarking data to evaluate their accuracy. Consequently, results from these models cannot be validated, limiting the trustworthiness for informing disaster impact reduction policies.

This project addresses these issues by creating a scalable framework to assess and track post-disaster recovery by analyzing satellite imagery. The proposed framework focuses on building damage caused by wildfires, establishing a baseline from pre-disaster imagery and tracking recovery progress by continually reassessing imagery in the weeks, months, and years following the disaster. The developed model is integrated on an interactive webpage that allows users to easily assess damage after a forest fire in their area of interest. Analysis of recovery in Paradise, California following the 2018 Camp Fire reveals valuable insights that experts can learn from.

This research advances recovery management by enabling experts to build their predictions using data from the past disasters that best represent the event and community they are attempting to model. By improving the accuracy and detail of disaster impact prediction, this project will enable more effective strategies to enhance resilience, minimize losses, and accelerate recovery for communities facing future disasters.

33 Accessible maps and route planning for campus
Team UW Access

Carter Ibach, Soha Khan, Elize Kooij, Mateo Alvarez, Shrinjay Mukherjee

UW Access is a mobile-first web application that facilitates navigation between indoor spaces on campus by providing users routes tailored to their requirements. Current campus navigation depends on static paper maps throughout the buildings which cannot be used while moving around, and outdoor GPS apps lack accuracy about intricate routes on campus and indoor details. UW Access will aim to address these issues and help people navigate around campus.

Allowing users to input route preferences, such as using elevators, this application goes beyonds basic navigation to provide flexible routing options. Users can see routes with a visual map and a step-by-step checklist to track their progress along the route. The map highlights routes, indicating key steps such as stairs, elevators, or start/end points, as well as the user's location based on the route checklist.

Beyond accessible navigation, UW Access incorporates a crowdsourced reporting feature that allows users to flag service interruptions or mislabelled locations. Crowdsourcing issues allows the app to stay up-to-date when routes become inaccessible or unusable; this feature ensures our project goes beyond the static solutions. This application is designed for use by everyone, so the front-end design reflects that goal. The application conforms to WCAG accessibility standards by following the core principles of being perceivable, operable, understandable and robust. Through collaboration with users, especially those with accessibility requirements, usability and accessible design were insured. This focus on accessibility allows UW Access to serve as many people as possible and to help everyone navigate campus easier.

34 UW Business Process Improvements Team RAID

Fabien Michel, Ryan Mark, Regan Blair, Omar Al-Iriani, Noah Michael Sutton, Joseph Ma

Team RAID has partnered with the University of Waterloo to tackle a critical issue affecting the HR, Information Systems & Technology (IST), and Finance departments: duplicate student profiles in Workday. During peak hiring seasons, the university hires over 200 students, but crucial steps in the process are often skipped, leading to duplicate profiles across both Workday and WatIAM systems. This results in over 600 incidents annually, costing the university approximately $50,000, and causing significant inefficiencies in the hiring process.

Our solution focuses on preventing data duplication before it occurs, streamlining the process, and minimizing costly errors. We've collaborated extensively with HR and IST, refining the solution based on ongoing feedback. By researching best practices at similar organizations, such as Wilfrid Laurier University, Fidelity, and AutoTrader, we've tailored our approach to the university's specific needs and IT infrastructure.

A key aspect of our strategy has been regular engagement with stakeholders through weekly meetings. These discussions have helped us align our understanding of the challenges and keep our approach adaptable. Although initial alternatives were not selected by the HR and IST, these setbacks ultimately strengthened our solution. We have since worked with IST to refine our strategy, ensuring the solution is robust and flexible enough to handle edge cases.

We are also exploring the broader applicability of this solution to other institutions and businesses. By engaging with organizations, we have gathered valuable insights to guide future implementations and expansions.

Student Index

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