CAPSTONE DESIGN SYMPOSIUM

MANAGEMENT ENGINEERING

Engineering 7 Event Space
University of Waterloo
Waterloo, Ontario

#uwcapstone

UNIVERSITY OF WATERLOO

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CAPSTONE DESIGN SYMPOSIUM

MANAGEMENT ENGINEERING

2020 Engineering Capstone
Design Program Sponsor

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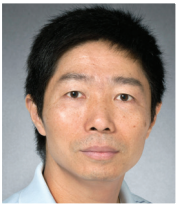
CAPSTONE DESIGN SYMPOSIUM

MANAGEMENT ENGINEERING

A MESSAGE FROM

QI-MING HE, Professor and Chair



I am delighted to invite you to the 9th annual Management Engineering Design Symposium. Our 15 teams of fourth-year Management Engineering students have worked hard over the past 12 months to find impactful and well-designed solutions for projects arisen from a range of emerging fields. The symposium will showcase their products, effort, and passion to the local community, fellow university members, industry partners, alumni and sponsors.

The projects span a wide range of topics, from e-sports and travel to enabling access to clean drinking water in Kenya. While the applications vary, projects leverage a number of tools and skills engrained throughout the Management Engineering program. These tools draw from the fields of mathematical modelling, operations research, data science, information systems, behavioral science and process design, to name a few. In addition, each team has also benefitted from a faculty member mentor, to ensure that their work is expertly guided throughout the capstone journey.

Every year, I am proud of the remarkable designs our students come up with, and I give my sincerest congratulations to yet another successful cohort. I would also like to take a moment to encourage future collaboration; if your organization would like to work with a management engineering team in the coming years, please contact Dr. Ada Hurst – our capstone design course instructor and coordinator, as detailed in page 19 of this book.

Have an enjoyable symposium!

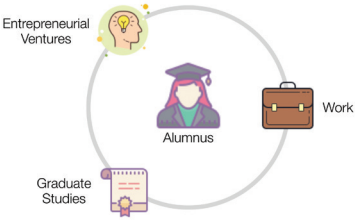
QI-MING HE
Professor and Chair
Department of Management Sciences

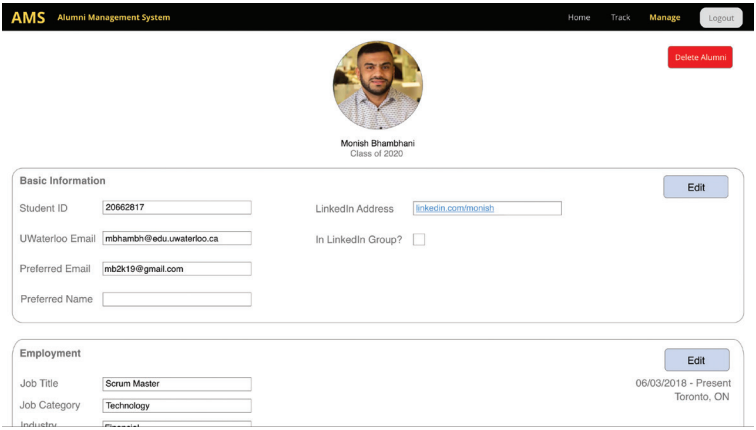
PARTICIPANTS

1 Alumni Management System for the Management Sciences Department

Alumni Management System (AMS) is a tailor-made customer relationship management tool geared towards continuing the relationship between alumni and the Management Sciences department after graduates leave Waterloo. AMS provides detailed statistics via an intuitive PowerBI dashboard on post-graduation endeavours that our alumni embark on, such as graduate studies, industries, companies, and startup ventures. It also provides an avenue for our department to provide news and updates to our alumni with customized mailing lists. AMS contains the past, present, and future information of our unique program.

YASH BHAMARE, BRANDON HOW TEIN FAT, PROF. KEN MCKAY, MONISH BHAMBHANI AND ASHAR KANDATHIL





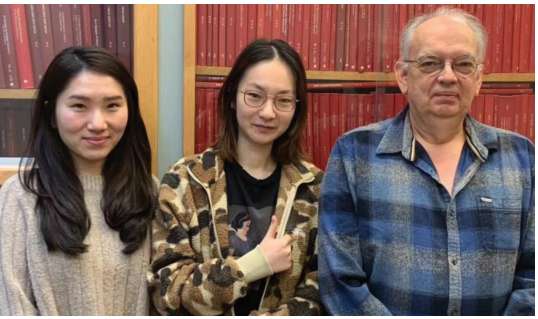
2 Emre: A Medical Records System for Iraqi Displacement Camps

Emre is an electronic medical records system built to support medical professionals in providing high-quality health care to residents in Iraqi displacement camps. Emre specifically targets the needs of physician assistants and doctors with respect to storing accurate patient data and capturing the state of a patient over time. Emre also provides support in both English and Arabic languages.

PROF. LUKASZ GOLAB, JONATHAN DHANAPALA, VICTORIA LI AND DANIAL BETRES

3 Onboarding System for the Poirier Group

Due to limitations in budget and human resources, the Poirier Group, a small boutique management consulting firm, required a custom-tailored onboarding system. To meet the needs of the firm, the new system was designed as a web platform with different levels of authorization. This system allows users to access the correct elements of our custom-built information system, where we store all the firm's onboarding documentation. All the progress is then tracked, then displayed as tables and graphs for administrators to view on a customized dashboard.



LEBIN DAI, YIZHEN HE AND PROF. KEN MCKAY. NOT PICTURED: MATHAN PREMACHANDRAN AND ABISON VIJAYAKANTHAN.

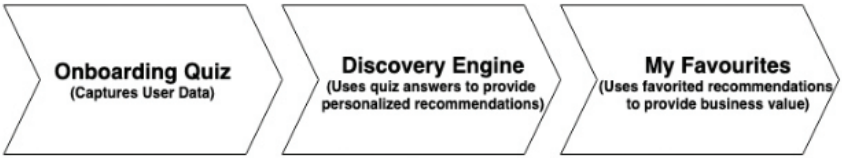
THE POIRIER GROUP

4 Travveli: It's not the Destination, It's the Journey

Have you ever felt that you spend way too much time trying to figure out your next holiday destination? On average each traveller searches over 32 sites before finalizing their next travel destination. Travveli is an application that is here to serve as a personalized travel discovery solution where you can build your dream trip based on your interests, behaviors and activity patterns. Travveli also provides airlines companies the ability to pre-emptively gather insightful data about potential customers to improve their digital targeting efforts.

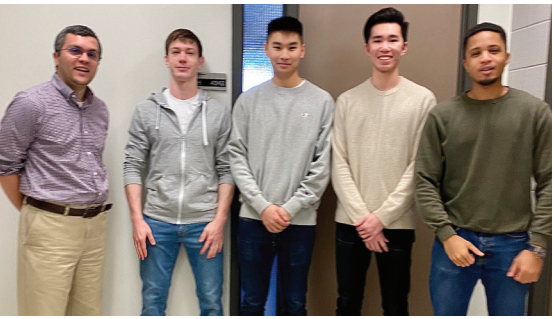
TRAVVELI
It's not the Destination,It's the Journey

ELSIE ESKANDAR, NOAH BEZAIRE, RISHABH BAHRI, MICHAEL BOTTONE AND PROF. IGOR IVKOVIC



5 Climactic: Highlight Generation for Long Format Entertainment

Being a fan of a sport is not easy, often not having the time to watch a full game, let alone all the other games that happen in a league or tournament. As more consumers rely on highlighted versions of long format entertainment like sports, content owners are pressured to create more time efficient videos to continually engage their viewers. Climactic is a proof of concept tool that reduces full length videos into highlight compilations, specifically focusing on sports and e-sports with commentary.



PROF. STAN DIMITROV, MATTHIEU COURT, TYLER LAM, KEVIN LEE AND ELDRICK WEGA

Climactic

In 2017 alone,

- Highlight and scene compilation videos had quadrupled
- Watchtime of sports 'highlight' videos grew more than 80%
- "What you missed" entertainment had more than doubled

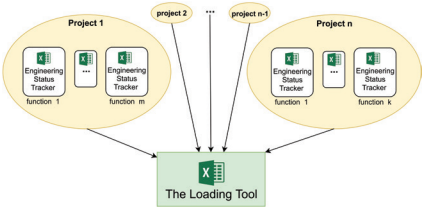
Data taken from YouTube

People want Highlights!

1. **Upload** video link
2. **Analyze** content
3. **Provide** highlight reel

6 A Project Planning Tool for ATS Automation

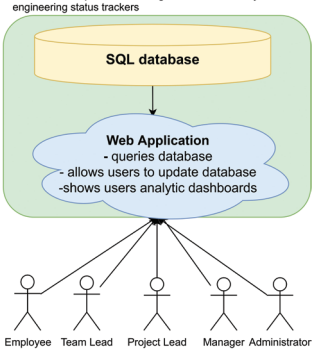
We designed a custom project management tool for ATS. This tool will replace the two Excel sheets that are currently being used by ATS in order to keep track of labour hours, assign workers to tasks, as well as to view the status of projects. We started by analyzing the current process for project planning. Through that analysis, we have found various redundancies, eliminated them, and created a web application that will greatly simplify the current process of project management.



TYLER FRONCHAK, BARAA AL-RAWI, PROF. OLIVER SCHNEIDER, YA JIAO AND LUKE MELOCHE

Our proposed system

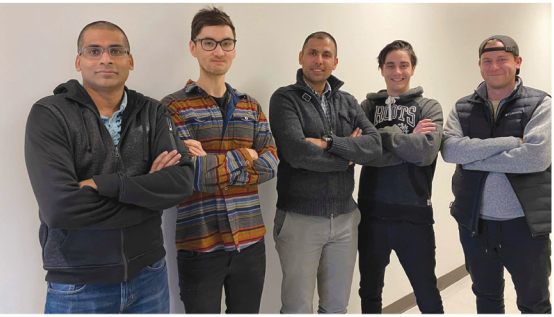
it is meant to replace the loading tool as well as unify all engineering status trackers



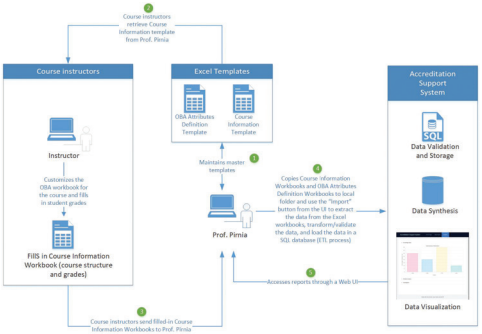
Action	Authorization Level				
	Employee	Project Lead	Team Lead	Manager	Admin
Create new task groups, tasks and subtasks in a task register	x	x	x	x	x
Schedule hours for an employee to work on a subtask in their project	x	x	x	x	x
Log actual hours worked on a task	x	x	x	x	x
Update completion percentage of tasks	x	x	x	x	x
View an employee's upcoming scheduled hours and subtasks	x	x	x	x	x
View all milestones for a specific function, and compare scheduled and actual completion dates	x	x	x	x	x
View high-level project details	x	x	x	x	x
View all employees in a department and their available work hours	x	x	x	x	x
View whether an employee is over/under booked	x	x	x	x	x
Create a new project and edit high-level details		x	x	x	x
Create a new task register for a specific function		x	x	x	x
Create custom milestones for a specific function		x	x	x	x
Save a copy of the initial project schedule		x	x	x	x
View the total weekly hours by function and copy into a separate internal software tool		x	x	x	x
Adjust an employee's available work hours (ex. vacation)			x	x	x
Add a new employee to the system				x	x
Add a team in the system and adjust which employees are in the team				x	x
Change an employee's job position				x	x
Change the phase of the project (Potential->Firm->Complete)				x	x
Define the gates for a specific function				x	x
View scheduled hours of a specific department contrasted with its employee capacity				x	x
Compare budgeted hours to actual and forecasted hours, broken down by project				x	x
Edit an authorization level's access within the system					x

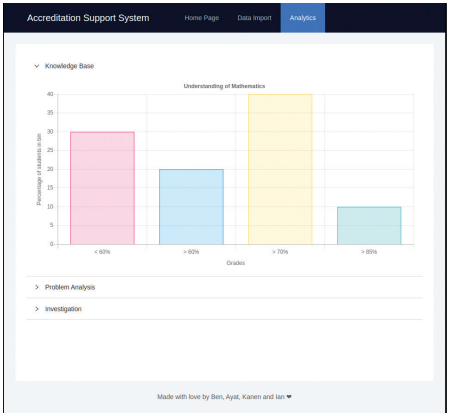
7 Accreditation Support System for the Management Engineering Program

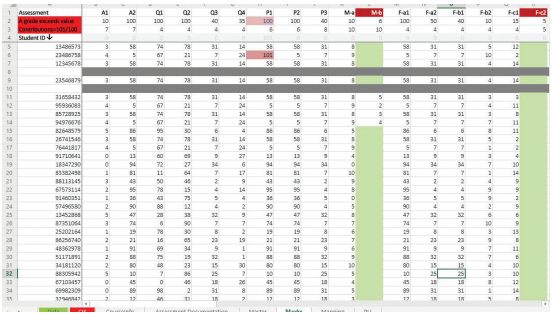
The Canadian Engineering Accreditation Board ensures that undergraduate programs meet educational standards acceptable for professional engineering qualification in Canada. Part of the accreditation process is to demonstrate that program outcomes are assessed in the context of the graduate attributes and that the results are being validated, analyzed and applied to further develop the program. This capstone project focuses on helping the department of Management Sciences improve their current processes, to better store and analyze the student data, which gets collected through outcome-based assessment workbooks.



KANEN VEERAPEN, AYAT TURAR, PROF. MEHRDAD PIRNIA, IAN MCDONALD AND BENJAMIN YUKE







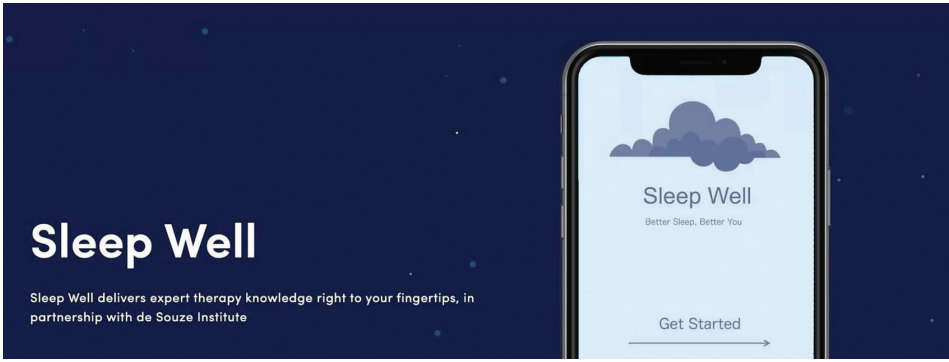
8 Sleep Well: An Interactive Mobile Application to Support Cancer Patients

Having quality sleep is an important factor to the success of a patient's cancer treatment. de Souza Institute provides continuing education in oncology and palliative care for health professionals and patients. The institute wants to both enhance sleep quality for cancer patients and reduce workload for current volunteering sleep therapists, but does not have the necessary resources. Sleep Well is an interactive mobile application that not only tracks a user's sleep schedule but also offers sleep enhancement suggestions tailored specifically to each patient's sleep pattern.

de Souza INSTITUTE

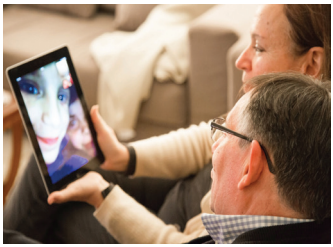
RUI ZHANG, AMANEE SYED ABID HUSSAIN, HILLARY MASHA,
HAIBEI WANG AND PROF. MARK SMUCKER

React Native iOS Android

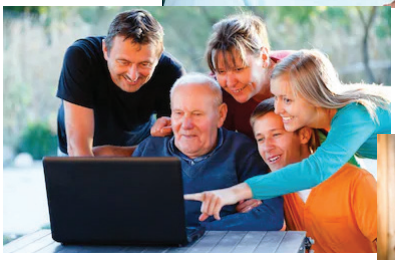


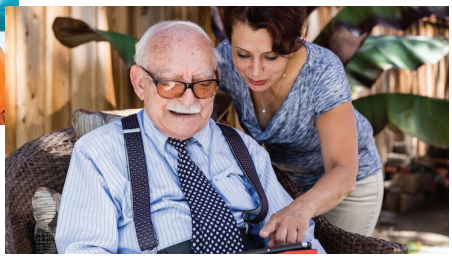
9 TechBoomers: Teaching the Ederly to use Social Media

The largest problems among the elderly are loneliness and social isolation. TechBoomers is a mobile application geared towards helping the average, non-technical elder learn the basics of modern technology. Social media has become a critical form of modern communication, but without instructional visuals and opportunities for hands-on learning, older adults are falling behind. TechBoomers focuses on active teaching, providing users with an extensive library of interactive walkthroughs regarding how to use popular social media applications, while maintaining a simple interface, free of passive reading.



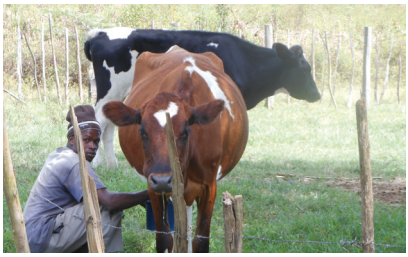
PROF. OLIVER SCHNEIDER, CAMPBELL MACRAE,
ANEESH KUMAR, ILIJA STANIC AND AKASH MALHOTRA

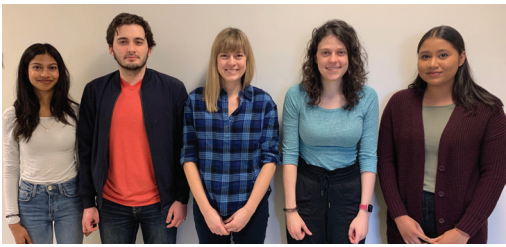




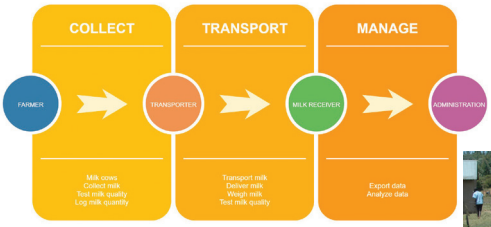
10 Kenyan Dairy Cooperative Milk Data Management System

Kenyan Kids Foundation Canada (KKFC) supports an initiative called Co-operative Dairy Development Project. The purpose of this Capstone project is to work with KKFC to help improve the dairy practices of farmers in the Cherangany region, where information for collected milk is currently recorded manually. Our solution is to provide a mobile application that allows milk transporters and receivers to record milk quantities and other relevant information. The solution aims to improve efficiency, increase traceability of spoiled milk, and reduce fraud.



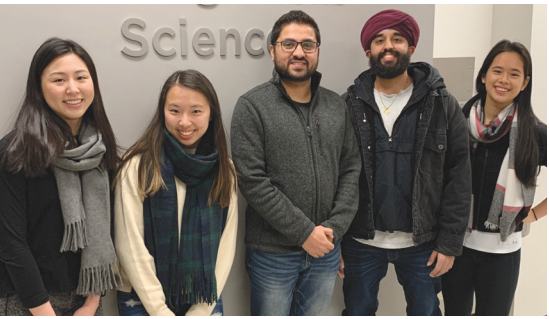


MALVIKA BALARAJ, AHMAD DAKHQAN, PROF. ADA HURST, CELESTE CASSEL DE CAMPS AND PRIYANKA BRODIE



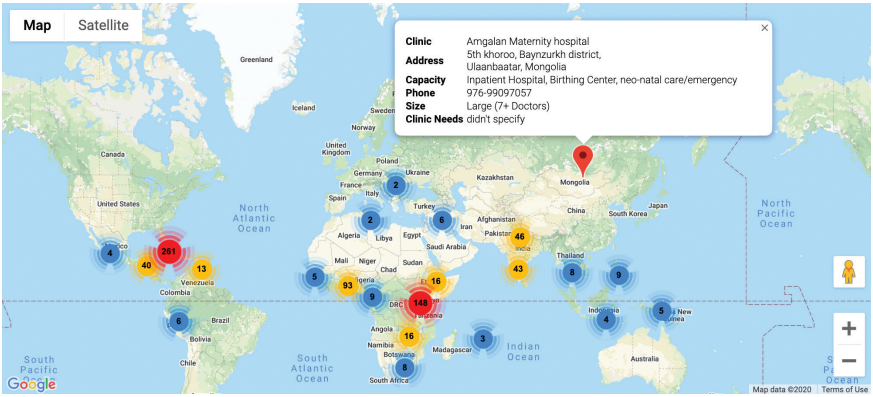
11 Process Improvement for the Not Just Tourists Organization

Not Just Tourists (NJT) is an organization founded with the purpose of getting medical supplies to those who can't afford them worldwide. NJT receives donations from Canada's largest hospitals, clinics, medical suppliers, and individuals. Solely through volunteer work, NJT packs medical supplies into suitcases and people who are travelling can sign-up to deliver them to remote clinics in the area. Our team aimed to improve existing features on their website to reduce cost and improve the workflow of volunteers.



KANYAPHA KITTANANTHAWONGS, MICHELLE CHENG, PROF. UMAIR SHAH, SATWANT SINGH AND CELINE YAU

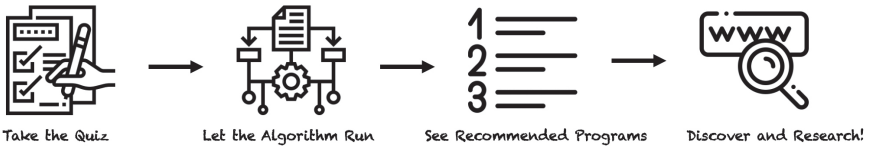
Not Just Tourist
Plus que touris

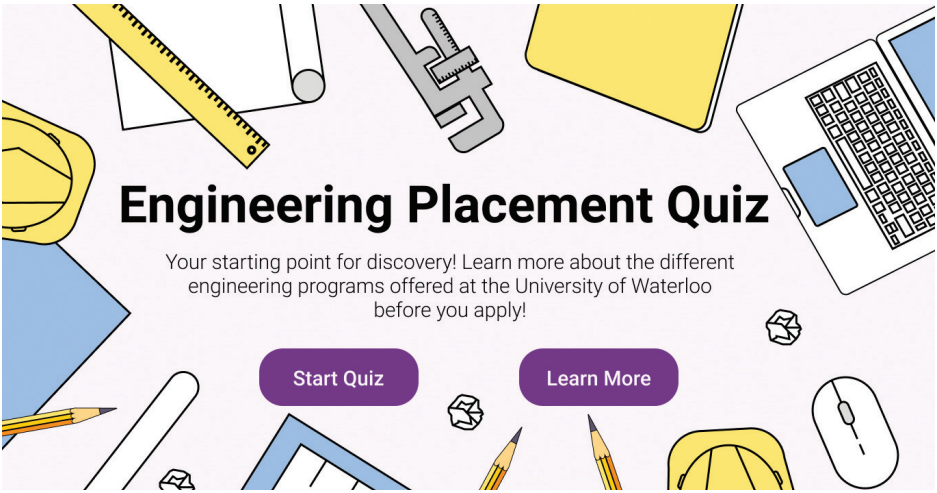


12 The Engineering Placement Quiz: A Decision Support Tool

The University of Waterloo offers 15 programs within the Faculty of Engineering for prospective students to apply to. Deciding what engineering program to apply to can be a daunting task, especially for high school students. That's where the Engineering Placement Quiz can help! The new-and-improved Engineering Placement Quiz utilizes a machine learning algorithm trained by data from both current UW students and alumni. The quiz helps students discover the different engineering programs that are offered, providing them with support in making an educated application decision.

BACK ROW: CLAIRE PANNOLINO, KAITLYN MASSEO, AYSER CHOUDHURY AND PROF. MARK SMUCKER; FRONT ROW: POOJA PATEL, RIM AL-HASSAN



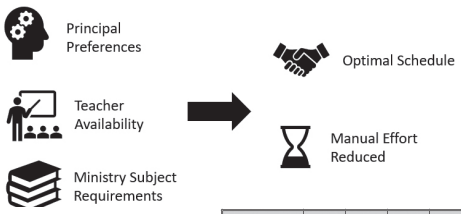


13 Smart Scheduling Tool: Improvement of Elementary School Timetables

Elementary school principals need to generate a full school schedule. Principals are challenged to build a schedule that meets the constraints of the Ministry of Education while satisfying teacher availability. This process can take up to five days. We developed a system that produces higher quality schedules for teachers and students, while reducing the overall process time. Using mixed-integer optimization techniques, our system considers several constraints to develop an optimal solution tailored to each principals' objectives generated in orders of magnitude faster than manual effort.

MEGHAN STRONACH, ALYSSA HOPKINS, PROF. SIBEL ALUMUR ALEV, ALLISON JACOBS AND SARAH MCCURDY

HAMILTON-WENTWORTH DISTRICT SCHOOL BOARD



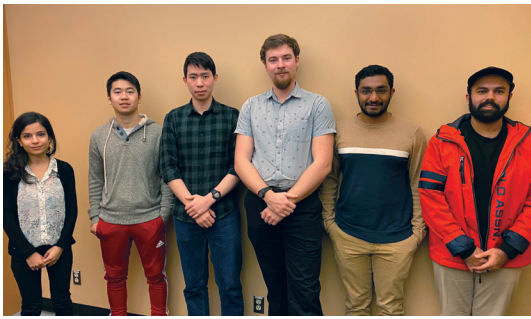
Teacher	F.T.E.	JK	SK	Gr. 1	Gr. 2	Gr. 3	Gr. 4	Gr. 5	Gr. 6	Gr. 7	Gr. 8	Sp. Ed.	Total Studen
Teacher A	1.0	9	6										15
Teacher B	1.0			9	5								14
Teacher C	1.0					14							14
Teacher D	1.0						10	3					13
Teacher E	0.7								27				27
Teacher E	0.3								27				27
Teacher F	1.0								10	15			25
Teacher G	1.0									26			26
Teacher H	1.0										23		23
Teacher I	1.0										23		23
Teacher J	1.0										23		23
Teacher K	1.0												0
Teacher L	1.0												0
Teacher M	0.2												0
Teacher N	0.2												0
Teacher O	0.6												0
Teacher P	1.0												0
Teacher Q	0.2												0
													0
Grade Totals	14.2	9	6	9	5	14	10	3	64	43	69	0	232
Projected Enrolment													0

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 - 8: 40	Science - Roberts	PE - Zora	Social Studies – Rogers	PE – Zora	Math - Tien
8:40 - 9:40	Language - Biam	Social Studies– Rogers	Music - Bland	Art- Bland	Math - Tien
10:20 - 11:10	Language - Biam	Art - Bland	Math - Tien	Language - Biam	Language - Biam
11:20- 12:00	Math - Tien	Math - Tien	Math - Tien	Language- Biam	Language - Biam
12:40 - 1:40	Art - Bland	Language - Biam	Language - Biam	Math - Tien	French - DeVernay
1:40 - 2:20	Drama- Bland	Language - Biam	Language - Biam	Math - Tien	French - DeVernay

14 Data-driven Insights for Buckland Customs Brokers Ltd.

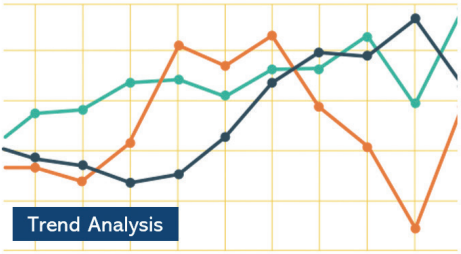
The logistics industry as a whole is facing uncertainty due to global political and economic factors. At the same time, logistics firms already collect a significant quantity of data through forms and manifests to demonstrate compliance to government agencies.

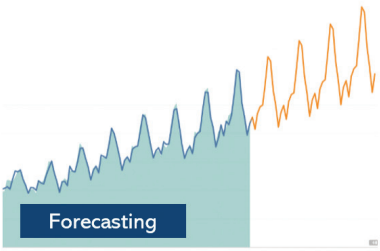
This project assists Buckland, a mid-size customs and brokerage firm based out of London, Ontario by leveraging their collected data. This data is analyzed by product, by shipment, and by client, to generate actionable insights in the form of trend analysis, forecasts, and clustering.



PROF. BISSAN GHADDAR, AARON YIM, JASON WANG, REED RODGERS, JERRY WILSON AND ALTAMASH PORBANDERWALA

BUCKLAND
Reaching Beyond Borders





Understand Domain & Problem → Understand Data Set & Semantics → Query Writing & Validation → Data Mining → Visualization

15 Improving Clean Water Accessibility in Kenya

In the Trans Nzoia county of Kenya, residents struggle to obtain access to clean drinking water. Their only current source of clean water is through one well, which is a prohibitively far commute for many residents. Our aim is to provide easier access to safe drinking water by optimizing the location of water access points for the entire region, while also considering costs and water demand. This water system will impact hundreds of people in need, making a significant difference within the Trans Nzoia community.

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CAPSTONE DESIGN SYMPOSIUM

MANAGEMENT ENGINEERING

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Our sincere thanks go to all of our professional, technical and administrative staff that assist our students during the course of their design project experiences

Future design projects

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