



APPLICATION FOR COUNCIL INNOVATION FUND

CC 941 (R2019-10)

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Date of Submission

2021-05-01

Name of Project

Mount Royal University – AI Digital Twin for Trucks

Sponsoring Councilor

Councilor George Chahal

Applicant Name

Dr. Rajbir Bhatti and Amit Varma

Applicant Contact Number

825-712-6055

Include area code, no spaces

Applicant Business Unit or Name of Organization

Faculty of Business and Communications Studies: Bissett School of Business, Mount Royal University

Affected Business Units and/or Departments

Transportation Department, Fleet Services, and IT

Amount of Funds Requested - please attach budget breakdown details in an attachment

\$50,000.00

Draft PFC cover report attached

☒ Yes ☐ No

Please list supporting documents provided.

1. Trucking Digital Twin Schematic
2. Budget Breakdown

Applications for the Council Innovation Fund are to be submitted to the Chief Financial Officer Department (name of person) no later than six (6) weeks in advance of the targeted Priorities and Finance Committee (PFC) meeting date.

Only completed applications supported by a PFC cover report will be submitted for placement on the PFC agenda. The PFC will review the report and proposal and provide their recommendation to Council. The recommendation and report will then be forwarded to Council at their next scheduled meeting.

The project proposes an “AI-Powered Digital Twin” for the trucking sector in Calgary. This is done as a technology sandbox so that Mount Royal University (MRU) students can use the data contributed by Calgary’s small and medium size trucking companies, to learn from and build solutions that give them a competitive advantage. Everyone wins - students learn, the small and medium sized- trucking companies in Calgary get ready-made solutions, and the City of Calgary promotes a digital economy. With the City’s support on this project, internal City departments can also enjoy access to all learnings from this project, to improve their own efficiencies.

Background:

In trucking, AI powered Digital Twins are used in a variety of applications - from monitoring the health of a truck, predictive maintenance, predicting machine failure, improving fuel savings, management of fleets, and optimization of logistics systems. Sensors generate data that flow into a data lake, which then uses Machine Learning to make the trucking operation “continuously more efficient”. Imagine 15% fuel savings, knowing when a breakdown is going to happen, or a 30% reduction in empty miles driven! These make a difference between a thriving business or becoming uncompetitive and losing critical mass.

While large truck manufacturers, OEMs and fleet owners can invest in AI for competitive advantage, small and medium fleet owner-operators just cannot do it, as they don’t have the scale, size, and/or the resources to invest in cumbersome and expensive AI-based asset-optimizations. Calgary has many such small and medium sized truck owner operators who can benefit significantly if they can get access to such pioneering technology that supports predictive and prescriptive management. Why should they be left behind? Why can’t the playing field be leveled to enable such local Calgary truckers to compete with larger organizations.

Project Logistics:

MRU professors from the Department of Supply Chain Management in collaboration with Braintoy, a local Calgary technology company, will manage and run this project. The university provides faculty, students, laboratory hardware and software support, including the state-of-the-art CN Supply Chain Data Analytics Lab. Up to 10 undergraduate students will be trained each year to be qualified as experts in Artificial Intelligence. It is expected that 100 small and medium trucking businesses in Calgary get value from this project.

Benefits:

Calgary’s small and medium size trucking companies get an opportunity to create value. New solutions and technology investments are becoming the largest driver of the economy. IDC Canada forecasts an estimated \$7.5 billion will be spent in Calgary through 2022 with Calgary companies leading the \$18.4 billion forecasted to be spent in Alberta. Spending on technologies and services enable digital transformation of business practices, products, and organizations across all industries. The three industries in Calgary that will invest the most in digital transformation from 2019 to 2022 are: Energy (\$1.9 billion), creative industries (\$1 billion), and life sciences (\$627 million). This project will add a fourth (and crucial) sector, *Transportation!* - a sector that is important to Calgary’s economic development but has traditionally not been an early adopter of technologies like AI. This intervention is especially vital in the aftermath of the COVID-19 pandemic.

This proposal is a classic “triple helix” innovation model, which refers to interactions between academia, industry and government to foster economic and social development. It assumes that the driving force of economic development is the production and dissemination of socially organized knowledge. As interactions increase within this framework, each component evolves to adopt some characteristics of the other institution, which then gives rise to hybrid institutions. In this project, bilateral interactions exist between university, industry and government. A Calgary post-secondary institute (MRU) works with a Calgary technology business (Braintoy), helping Calgary small and medium size businesses (trucking owner-operators), with the support of the municipal government of Calgary. All elements of success exist to develop a local solution for effective fleet management that reduces Total Cost of Ownership (TCO) of trucks – the lifeline of any economy.

Since this is a local-made solution for Calgary's economy, the cycle of economic development and growth remains in Calgary! The direct savings to each fleet operator is estimated to be 15-30% in efficiency. There is a gap in Maintenance & Repair (M&R) costs as vehicles age. By using better prediction tools, and effectively utilizing the existing life of Maintenance, Repair and Operations (MRO) components, that gap can be bridged to save the differential amount, even as the vehicle ages. Hence, if small and mid-sized trucking companies can use better knowledge management tools, they can lessen increasing M&R costs. Based on a recent report on lifecycle strategy, with calculations derived from AI-powered TCO software, M&R costs on a 2015 truck compared with a new 2020 truck can provide savings of approximately \$12,000. With a fleet of 100 trucks, this can amount to an annual savings of **\$1.2 million**. This stays and grows within the local economy.

The project also benefits the research and development (R&D) and economic growth of the AI/ML industry in Calgary. In the last two decades, Alberta has invested over \$40 million towards AI/ML and is home to 1 of 3 Canadian AI hubs. It has been successful in drawing world-class AI innovators like Google, RBC and Mitsubishi to the province, who have opened research facilities here. Provincial & federal AI investments are estimated to result in more than 6,000 trained, skilled Albertans, the creation of over 140 new companies, over 30 new multi-national offices, labs in Alberta, over \$207 million in leveraged investments by industry, increased competitiveness and productivity of at least 150 Alberta businesses. A very small percentage of this AI centric development has come in the transportation sector!

Immediate benefits can be measured in terms of the ability of fleet managers to:

- Predict on-road tire failure (validated as the most significant impact item)
- Optimize Maintenance & Repair (M&R) costs and Total Cost of Ownership (TCO)
- Reduce cost of consumables such as fuel and engine oil (reduced cost, environmental impact)
- Increase asset utilization (reduced cost, increased revenue)

The City would foster economic development and diversification by supporting research and development, using MRU's research expertise in transportation and supply chain management, all the while helping local small and medium size trucking companies to improve their productivity and profits. Academically, this project will result in peer reviewed research publications for MRU faculty and students.

The project is innovative in nature since it presents a new approach to improve productivity in fleet management scenarios. The funding from the City of Calgary will be used to initiate the project - hire student interns, faculty release time, data scientists, and deploy the technology for the project. It is expected that each dollar of this investment is matched by other grant sources - matching funds will be requested from MITACS, a federal government program to support academic research involving students, and the Western Economic Diversification Canada.

Roles & Responsibilities:

The City of Calgary:

Provide a one-time seed funding of \$50,000 through the Council Innovation Fund to initiate the development of this project. Because of the funding, enrollments from the City of Calgary departments is at no cost. GMS stakeholders and departments will communicate and collaborate with MRU researchers.

Mount Royal University:

Provide student interns, faculty support, software, hardware, and access to the CN Supply Chain Data Analytics Lab. MRU finds and enrolls participants (trucking owner-operators, City of Calgary departments, etc.), collaborate with the technology partner to obtain, analyze, anonymize, and secure the trucking data on a dedicated computing instance, and guides the students to build and deploy models that solve problems. Because of the funding, truckers enroll at no cost. Their role is to simply supply a problem, give data, and validate solutions with the MRU researchers from time to time.

Braintoy Inc.:

Provide the Machine Learning Operating System and Data Scientists to assist incubating and supporting the project. Training MRU faculty, as well as all improvements in technology comes at no cost to the project.

Identify how this project meets the criteria as outlined in the Terms of Reference for the Council Innovation Fund.
Please attach additional information as required.

The proposed project:

- a) Meets the innovation definition as set out in the Terms of Reference because a digital twin will improve and optimize the performance of a physical object (in this case trucks owned by small-mid sized trucking companies in Calgary).
- b) Supports Council's priorities of A Prosperous City, as this program supports the key industry sector of Transportation and Logistics.
- c) Has the potential to change city-wide policies and procedures, if successful upon implementation since it could also help perpetuate the digital transformation of other services throughout the organization in the future.
- d) Is viable and sustainable in the long term given that the global digital twin market has not only increased significantly over the last few years, but it's expected to continue growing in the coming years.
- e) Is fiscally sound because the Prepare and Share phases (shown below) will be completed in-kind. It is also anticipated that the requested funding will be matched by other grant sources, including MITACS, a federal government program to support academic research involving students, and the Western Economic Diversification Canada.
- f) Will be managed well, as outlined in the roles and responsibilities above.
- g) Has not previously received a CIF grant.

Outline the proposed timeline for this project, including the final report back date.

The project starts March 2021. It is expected to achieve the outcomes by February 2022, i.e. in 12 months.

Mar – May 2021 (Prepare):

- Funding applications
- Enrollment of participants (SMB trucking companies, MRU faculty and students, City of Calgary)
- Write use cases and data collection

June 2021 – February 2022 (Complete):

- Technology deployments
- Training MRU students
- Prove solutions by validation

February 2022 onwards (Share):

- Enroll more businesses
- Enroll more colleges and universities

April/May 2022:

- Final Report to PFC on program execution, including lessons learned

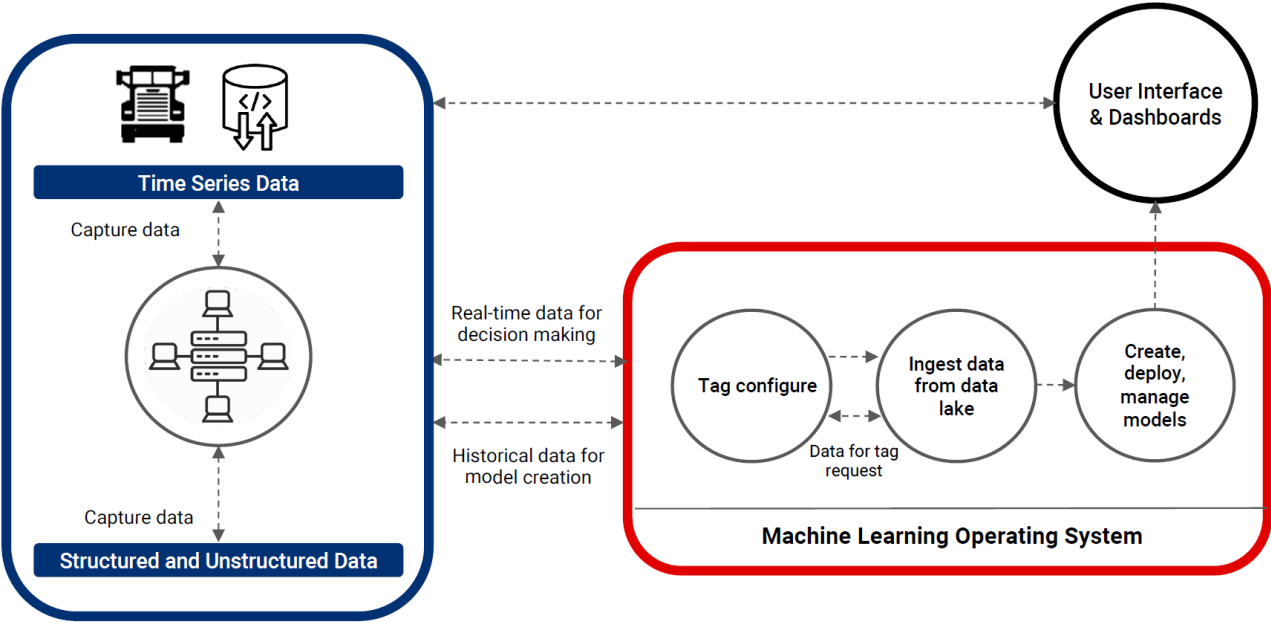
Identify what success looks like, and how it will be measured.

The project will be a success if:

- **Max.** 10 students and researchers from Calgary are sourced and trained
- **At least** 10 Calgary trucking companies / City departments participate in this program
- **At least** 10 AI solutions are made by MRU students during the project

Your personal information is being collected, used and disclosed for the administration and processing of your application for funding under the Council Innovation Fund Project. Your information is collected pursuant to section 33(c) of The Freedom of Information and Protection of Privacy Act ("FOIP Act") of Alberta. If you have any questions about the collection, use or disclosure of your personal information, please contact The City of Calgary's Chief Financial Office (#8003), The City of Calgary P.O. Box 2100, Stn. M, Calgary, AB T2P 2M5 and by calling at 403-268-5664.

AI Digital Twin Schematic



Supporting Document #2: Project Budget Breakdown

Phase	Activities	Timeline	Resources	Budget
Prepare	Participant enrollments (SMB truckers, City of Calgary, MRU faculty, MRU students)		Internal	In-kind
Deploy	Technology deployment (1 MRU instance)	Apr-Dec 2021	Braintoy	\$ 24,000
	Software licensing (10 users)		Braintoy	\$ 7,680
	Collect trucking data (10 participants)		MRU Faculty / Student Release Time	
	Use case writing (20-30 use cases)		MRU Faculty / Student Release Time	
	Develop prototype models (about 10 solutions)		MRU Faculty / Student Release Time	\$ 80,000
	Deploy and validate solutions (about 10 solutions)		MRU Faculty / Student Release Time	
Share	Enroll other businesses, colleges and universities	Dec-21	Internal	In-kind
	Final Report to PFC	Feb-22		
Total				\$ 111,680
Note: MITACS covers a portion of the Student Release Time. Hence funding of \$50K from City of Calgary is sufficient.				