Digital Transformation and Leak Detection of Hydrogen Pipelines through Artificial Intelligence and Digital Twin

This project is developing a digital twin system for online health monitoring and risk analysis for hydrogen pipeline transmission to improve the safety and leak detection capability for hydrogen pipelines. This hydrogen pipeline digital twin system will integrate into existing computational pipeline monitoring systems using real-time pipeline data to determine the occurrence, location and magnitude of leaks. It is also able to forecast the potential for leaks by performing simulations on the digitalized pipeline and performing risk assessments based on the simulated signals and domain knowledge.

FUNDING DETAILS
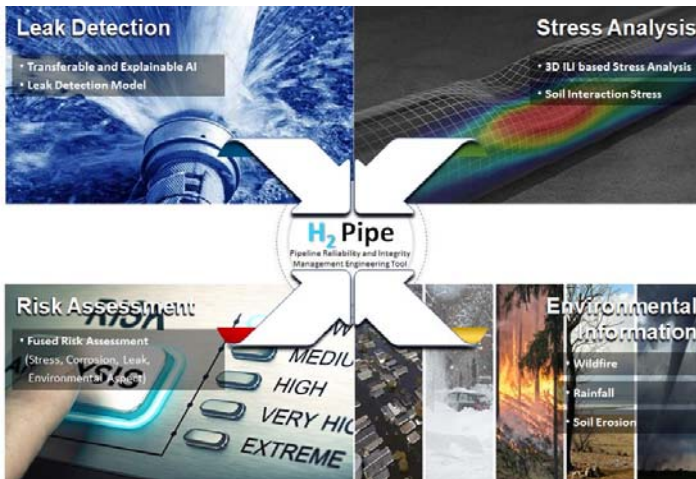
RECIPIENT:
The University of Calgary (Simon Park, Ron Hugo)

PARTNERS:
Pipewise Inc.

TOTAL BUDGET:
$470,000

AI FUNDING:
$200,000
DICE 2.0

PROJECT DATES:
MAR 2022 – AUG 2023

PROJECT TRL:
Start: 3
End: 6

APPLICATION

Hydrogen is useful as a replacement for diesel in commercial and heavy freight transportation, replacing natural gas for residential and commercial heating, and for industrial processes as a feedstock as it releases no carbon dioxide when used, only water. This software will be applicable for monitoring blended hydrogen and natural gas pipelines as well as pure hydrogen pipelines.

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PROJECT GOALS

- Develop a digital twin for online health monitoring and risk analysis for hydrogen pipeline systems
- Integrate capability into existing computational pipeline monitoring systems
- Forecast potential leaks through risk-based simulations
- Deploy a new leak detection technology with high sensitivity and accuracy for hydrogen gas transmission pipelines

BENEFITS TO ALBERTA

- Enables the construction or retrofitting of pipelines for hydrogen service
- Enables the safe and efficient development of a hydrogen economy in Alberta
- Generates potential revenue for other markets to support hydrogen deployment regionally and internationally
- Enables economic diversification for Alberta
- Enables greenhouse gas reductions through supporting the broader deployment of low carbon intensity hydrogen
- Supports job growth in the hydrogen economy in Alberta

3 Publications   **5 Students Trained**   **1 Patent**   **1 Project Job**   **8-10 Future Jobs**

1 New Product/Service   **1 Spinoff Company**   **0 kt/yr Project GHGs Reduced**   **40,600-73,800 kt/yr Future GHGs**

CURRENT STATUS

JUN 2022
Literature review, pipe stress analysis modeling, preliminary pipe model software interface development, and hydraulic simulator for blended hydrogen gas are all underway.