



IC-IMPACTS



**2023-2024
ANNUAL REPORT**



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YEAR IN REVIEW

We are pleased to report that IC-IMPACTS continued to advance research collaborations and knowledge transfer between Canada and India, and launched a number of new Calls for Proposals.

In recent years, we have seen steady progress resulting from IC-IMPACTS Canada-India scientific collaborations as we continued to develop community-based solutions in the areas of Public Health, Safe and Sustainable Infrastructure, Integrated Water Management, and more recently, in Food Security and Agritech.

IC-IMPACTS unique model is a tangible demonstration of the importance of collaboration in science and technology and we particularly value the support received from the Government of India through the Departments of Biotechnology (DBT) and Science and Technology (DST).

With the signing of the Memorandum of Understanding (MOU) between India's Department of Biotechnology (DBT) and Department of Science and Technology (DST), and Natural Sciences and Engineering Research Council of Canada (NSERC), IC-IMPACTS was identified as the lead delivery agency on Canada-India Science and Technology collaborations.

Immediately following the MOU, IC-IMPACTS, DBT and DST launched a new Call for Proposals on Building Resilient and Carbon-Neutral Communities Post COVID. The response to the Call was beyond our expectations as we received more than 150 applications by researchers from across Canada and India. IC-IMPACTS, DBT and DST mutually agreed to fund 19 of these highly innovative projects.

We are grateful to our entire team whose ongoing dedication and commitment to IC-IMPACTS is heartening and inspirational. We also acknowledge the amazing and continued support we have received from NCE.

We are pleased to present the IC-IMPACTS Annual Report for the 2023-2024 fiscal year.

The past year has been marked by opportunity, discovery, and development. This report highlights the significant influence of our network on research, innovation, and student training. It showcases key accomplishments that exemplify how Canada-India partnerships continue to drive meaningful innovation.

At IC-IMPACTS, our initiatives are guided by community needs, with a steadfast focus on helping communities adapt to an ever-changing world. We continue to strengthen collaborations between Canada and India, expanding our proven model of applied research through strategic industry partnerships and active community engagement. Our efforts aim to enhance the well-being of communities in both countries, while remaining firmly grounded in science-based research and social innovation that accelerate trade and improve lives.

Our collaborations with the Government of India's Department of Science and Technology and the Department of Biotechnology have strengthened over the years. These collaborations have resulted in exciting new research in the areas of health, water, infrastructure and agritech.

IC-IMPACTS remains deeply committed to cultivating innovative training and networking opportunities for our Highly Qualified Personnel (HQPs), empowering graduate students and postdoctoral fellows to become future leaders in research and innovation. With 1,549 HQPs trained, IC-IMPACTS continues to create innovative and hands-on training and networking opportunities for our HQPs.

Our researchers have produced 1,644 peer-reviewed research publications and launched 8 start-ups. IC-IMPACTS continues to play an important role in developing partnerships between researchers and companies. With more than 420 partnerships created and 34 patents, IC-IMPACTS is accelerating knowledge-based trade between Canada and India.

Through meaningful collaborations with First Nations communities across Canada, IC-IMPACTS has contributed to transformative social change within Indigenous communities. The success of these initiatives has enabled the scaling and implementation of IC-IMPACTS technologies in communities across both Canada and India.



Mr. Barj S. Dhahan
Chairman of the Board of Directors



Dr. Nemy Banthia
Chief Executive Officer and Scientific Director



RECENT WORKS

Translating Research Into Communities

IC-IMPACTS AT A GLANCE

95
RESEARCH
PROJECTS

1,549
HQP
TRAINED

420
PARTNERSHIPS
CREATED

8
START-UPS
LAUNCHED

34
PATENTS
FILED

1,664
SCIENTIFIC
PUBLICATIONS

In July 2022, following the signing of the MoU between DST, DBT, and NSERC, a Canada-India Joint Call for Proposals on Building Resilient and Carbon-Neutral Communities Post COVID was announced.

The purpose of the Call was to seek applications in the areas of Infrastructure, Water, Agritech and Food Security, and Health – Post COVID Health Issues and Long COVID.

In the following months, IC-IMPACTS received over 150 applications, 134 of which were considered eligible for review. Each of these applications were independently evaluated by a Joint Review Committee, comprised of representatives and independent external reviewers from India and Canada, followed by comparison of list of proposals recommended from both Canadian and Indian sides to the Selection Committee.



ANNOUNCING THE FUNDING OF 19 PROJECTS

ADVANCING RESEARCH:
INNOVATION
DEMONSTRATION
COMMERCIALIZATION

DEVELOPMENT OF INNOVATIVE TECHNOLOGY

IC-IMPACTS' bilateral Canada-India model is identified and driven by community need, with outcomes being deployed internationally, from Canada's Indigenous communities to urban and rural communities in India. The following theme-based examples demonstrate the success of IC-IMPACTS' model.

Food Security and Agritech

Irrigation Management Using Deep Reinforcement Learning

Canadian Lead: Dr. Chi-Guhn Lee, University of Toronto

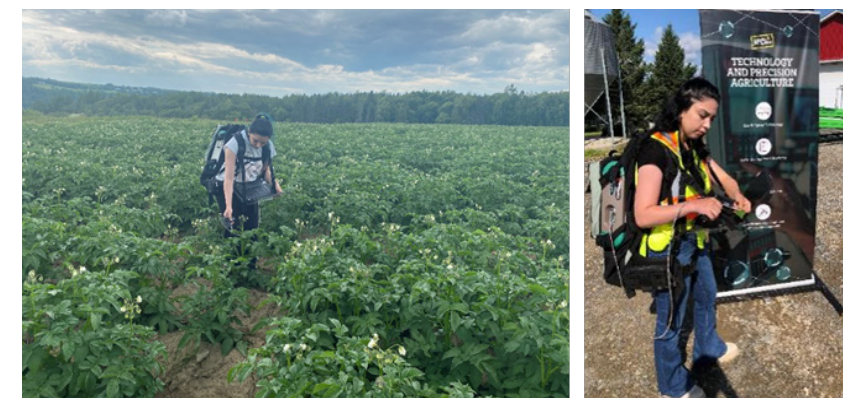
Indian Lead: Dr. Subimal Ghosh, Indian Institute of Technology – Bombay

Previous studies on optimal irrigation scheduling have primarily relied on static optimization with chance constraints, assuming predetermined distributions of rainfall to determine optimal irrigation plans over a short-to-medium weather forecast range of 1-7 days. However, if farmers deviate from this optimal plan due to unexpected circumstances during the planning window, the original irrigation plan becomes suboptimal, and the entire optimization process must be restarted to obtain optimal decisions for the current soil moisture level.

During the current stage of the irrigation management project, the Canadian research team collaborated with the India Team and conducted data acquisition and processing to obtain rainfall data from GEFS and irrigation data from farmers at the specific site. Additionally, researchers obtained benchmark performance from their simulation-optimization method. A training environment by studying the hydrodynamics of the farm, including soil moisture differential equations, PET process, and the farmer's irrigation process was developed. Subsequently, researchers created a Python code to simulate irrigation using any method that respects the hydrodynamics of the site.

To optimize irrigation, the team incorporated the weather model into the Deep Reinforcement Learning (DRL) algorithm by including weather model parameters as part of the state for the agent and updating them as state transitions due to new information from the environment. Then designed the action space to allow for irrigation at irregular intervals and to respect the maximum water usage per irrigation due to the specific way farmers irrigate (using ground water and irrigating in irregular daily intervals).

Researchers then evaluated the proposed DRL method by comparing it with benchmark methods (farmer's method and simulation optimization method) in terms of water usage and soil moisture level evolution. Results indicate an average of 30% reduction in total water usage compared to benchmark methods, while maintaining appropriate soil moisture levels and similar crop yield.



Variable Rate Application of Nutrients by Developing Nutrient Estimation Sensor and Precision Spraying Mechanism

Indian Lead: Dr. Ahmad Al-Mallahi, Dalhousie University

Canadian Lead: Dr. Narasimha Murty, Indian Institute of Technology – Tirupati

This project is separated into two different developments, sensing and spraying, which get combined at the time of deployment. Firstly, the sensing system of nutrients in plants was developed based on a new machine learning technique that does not only assume relationship between spectral reflectance of leaves and petioles but also finds and incorporates the effects of the nutrients on each other.

The method of correlating leaf reflectance and petiole nutrient content was published in a peer-reviewed article and was submitted to McCain Foods as an invention disclosure and is being negotiated for patenting and licencing. The part of correlating soil and plant status was delayed as the team relied on obtaining one in-bound Mitacs Global Link Award to move the work forward. Nevertheless, the award is granted and one HQP from India is scheduled to conduct internship in Canada after getting his study permit. Secondly, a new spraying mechanism which allows for accurate spraying was assembled in India using components provided to Dalhousie by one of the research partners. The new nozzles allow for spraying backwards in angle of 55 degrees which can compensate for time delays caused by the sensing or mechanical components. Several communications through presentations were done during the past fiscal year, and a full article co-authored with the colleagues at IIT Tirupati is expected to be written this year.

Integrated Water Management



Development and Scale-Up of Technology for Microbial Extraction of Xylose from Agro-Waste Materials and Subsequent Conversion into Xylitol: Conversion of Hydrolysed Lignocellulosic Residues into Biopolymers for Applications in Composites.

Canadian Lead: Dr. Tatjana Stevanovic, Université Laval
Indian Lead: Dr. Baljinder Kaur, Punjabi University

This study involves quantifying the major constituents of rice husk and wheat straw, namely hemicellulose, lignin, cellulose, and ash. In the first year, the team optimized the extraction of xylose. In the second year, hydrolyzed biomasses was converted into biopolymers lignin and cellulosic pulp using a patented organosolv process. Organosolv lignins obtained from both original and hydrolysed rice husks and wheat straw were rigorously analyzed, by spectroscopic and chromatographic methods.. Due to large amounts of residual silica in the cellulosic pulps it was difficult to study the properties of the cellulose, so the team established and optimized a mild silica extraction process using Na₂CO₃. The absence of silica in the ash produced from the purified cellulose, confirmed through elemental analysis, was taken as a proof of a successful purification.

To facilitate spectroscopic analysis, the cellulose pulps were further bleached by successive treatments by NaClO₂. The bleached cellulose was then analyzed rigorously. The scaling up of the hydrolysis and pulping processes was necessary to produce biomass and validate its conformity. Using the electrospray method, rice husk lignin was transformed into nanoparticles. The team optimized various parameters, including lignin concentration, flow rate, applied voltage,

and tip-to-collector distance, using a response surface methodology with the Box-Behnken design to obtain small, spherical, stable, and homogeneous nanoparticles. Finally, the lignin particles were incorporated into a polylactic acid (PLA) matrix to enhance the antioxidant properties of PLA films used for food packaging.

Using high intensity ultra sonification, rice husk cellulose was transformed into fibrillated cellulose.



FILTRATION OF ORGANOSOLV PULP AND LIGNIN KLASON

Carbon Neutrality through Combined CO₂ Capture and Novel H₂ Technology with Production of Non-Conventional Fuels for Smart Cities

Indian Lead: Dr. Ibrahim Dincer, Ontario Tech University
Canadian Lead: Dr. Subrata Borgohain Gogoi, Dibrugarh University

Increasing energy demand drives the need for environmentally sustainable and economically viable renewable resources to eliminate problems related to greenhouse gas emissions. In this ground-breaking project, the research group has successfully adapted a conventional gasoline-powered generator to run on various hydrogen-blended fuel mixtures. Gasoline, methane, and propane is used as the base fuel. Each have been mixed with the ratios of 5, 10, 15, and 20%. In order to make a comparison, the cases without hydrogen have also been experimented.

Researchers have observed that significant reductions in harmful emissions across all blends with increasing hydrogen content in the fuel mixture. In the case of without hydrogen which are used gasoline, propane and methane, while the emissions tend to decrease due to lower carbon content of the propane and methane, the power output of the generator has reduced. The reductions are observed 6.1% with propane and 10.4% with methane. On the other hand, while propane has reduced the CO₂ and CO emissions 10.4% and 43%, the methane has provided 21.7% and 62.1%, respectively. There was no significant change in NO_x emissions. The best case in terms of emissions is observed with the blend of 80% methane and 10% hydrogen. In this case, while CO₂, CO, and NO_x emissions are found to be 1,440 g/kg fuel, 12 g/kg fuel and 0.8 g/kg fuel. Also, it should be noted that the hydrogen has compensate the power reduction due to the use of methane in the engine. There was almost no power reduction in the power generator.

Safe and Sustainable Infrastructure



Sustainable Earthquake-Resistant 3D-Printed Concrete Housing: From Laboratory Testing to Industrial Application

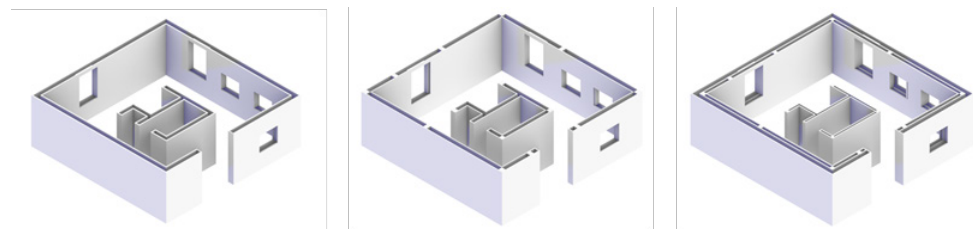
Canadian Lead: Dr. Vahid Sadeghian, Carleton University

Indian Lead: Dr. Biranchi Panda, Indian Institute of Technology – Guwahati

3D printed concrete (3DPC) has the potential to revolutionize construction industry by using robotic technology. Similar to any other new technology, 3DPC presents new challenges that must be addressed before it can be utilized on a large scale by the industry. The main goal of this research program is to develop sustainable seismic-resistant 3DPC buildings by conducting experimental testing and computer simulations at both the material and structural levels while also considering environmental impact and architectural requirements. Over the past year, the research team has made significant progress in all three aspects of the program: material science, structural engineering, and architectural design.

A comprehensive sensitivity analysis study has been conducted to gain insight into the behavior of 3DPC structures. Further, in collaboration with industry partners, specimen design and test setup preparation have been completed for quasi-static and shake table testing of large-scale 3DPC walls.

Regarding architectural aspects, various design strategies have been explored to reduce the carbon footprint and facilitate large-scale construction of affordable 3DPC housing. The proposed designs are among the first to incorporate prefabricated modular construction and topology optimization techniques with 3DPC to enhance construction efficiency and minimize material usage.



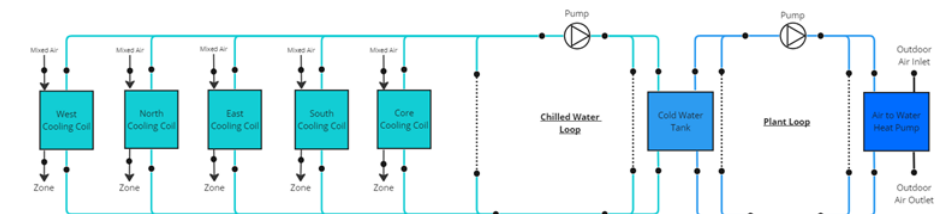
PROPOSED ARCHITECTURAL DESIGNS AND CONSTRUCTION METHODS FOR AFFORDABLE 3DPC HOUSING

Development of Cost-Effective, Energy Efficient, and Resilient Housing Technologies for First Nations Communities

Leads: Drs. Ashutosh Bagchi and Bruno Lee, Concordia University

The goal of this research is to evaluate and improve the resilience of housing in First Nation Communities to events caused by wildfires through implementing energy-efficient technologies. More specifically, this research aims to identify the optimal sizing of building technologies that give the best performance in terms of energy and comfort for the local climatic conditions and under extreme events.

Researchers have developed an energy model for a community center located in Val-d'Or, Quebec has been developed in EnergyPlus based on NECB. Energy and comfort analysis has been conducted for the baseline model. The ASHP and CWTES models have been developed in EnergyPlus and are sized based on the selected location climate. In addition, the resiliency indicators have been investigated. A holistic approach has been developed to automate the simulation of EnergyPlus models and conduct parametric design analysis in Python. And, parallel to this research, further analysis has been made to assess the robustness of heating and cooling systems under future climates.



SCHEMATIC OF THE INTEGRATED ENERGY SYSTEM CONNECTED TO THE COOLING COILS



Public Health

Smart Infrastructure with High Fracture Toughness, Durable Concrete Employing Large Amounts of Industrial Wastes

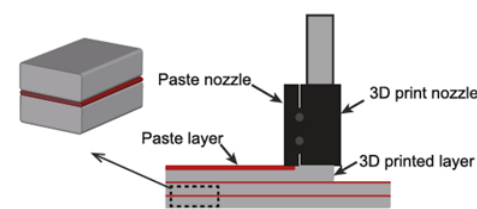
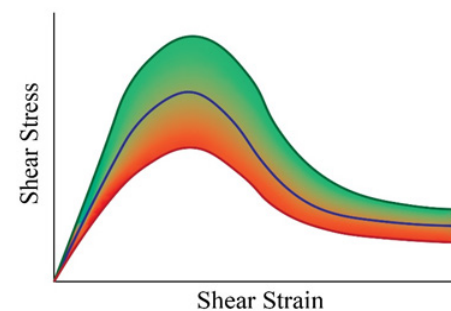
Lead: Dr. Nemkumar Banthia, The University of British Columbia

Repairing aged and deteriorated sewer infrastructure is an ongoing challenge for municipalities and is often complicated by the fact that sewer pipes are located in crowded and developed areas that have changed significantly since the original design and installation. To tackle this issue, the research team at UBC is collaborating with Metro Vancouver to develop a carbon-neutral, geopolymer coating with biocides (called multi-phase composite coating, MCC) that when applied on sewer infrastructure, will resist bacterial attack, prevent further corrosion and extend the infrastructure's existing service life. Novel assessment of Microbial Induced Corrosion has been adopted by industry to assess state of Metro Vancouver infrastructure. The material will be spray-applied as repair coatings on Metro Vancouver's infrastructure assets using robots.

Researchers have partnered with Avestec Technologies Inc. which is a Vancouver-based high-tech robotic company and will internationally market the semi-autonomous vehicle which will carry the scanning and spraying gear in the sewer pipes. Collectively, the team will continue to further develop and optimize materials and robotic placement processes to strengthen Canadian sewerage and offer this expertise internationally.

Two of the HQP working on this project have completed their PhD program and graduated; one

of whom has been hired as an instructor at BCIT and the other continued their work at UBC as a Postdoctoral Fellow. One Postdoctoral Fellow working on the project has completed their term and is now employed at University of Sheffield in the UK and has started a new chapter in their academic career. One MASc student will be graduating this year.



TESTING AND INTERSTITIAL LAYER ENHANCEMENT OF 3DPC

Smart App-Based Rapid Multiplex Screening of HIV Associated Co-Infections of at-Risk Populations at the Point-of-Care: A Demonstration Study in India

Canadian Lead: Dr. Nitika Pant Pai, Research Institute of the McGill University Health Centre
 Indian Lead: Dr. Syed S. Yazdani, International Centre for Genetic Engineering & Biotechnology (ICGEB)

In this study, the research team is screening populations for HBV and HPV – two viral infections that are commonly ignored in screening programs. The results from this study will influence testing policy and guidelines for sexually transmitted and blood borne infections. It will allow populations who are not commonly tested for these prevalent infections to know their status, thereby managing the undiagnosed disease burden and mitigating transmission.

Research Team at RI-MUHC:



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Professor, The University of Toronto

SCIENTIFIC TEAM

Dr. Nemy Banthia
Scientific Director and Theme Lead, Safe and Sustainable
Infrastructure, The University of British Columbia

Dr. Stewart Aitchison
Theme Lead, Public Health: Disease Prevention
and Treatment, Professor, Electrical & Computer
Engineering, The University of Toronto

Dr. Damase Khasa
Theme Lead, Integrated Water Management, Professor,
Department of Wood and Forest Sciences, Université Laval

Dr. Pratap Pati
Theme Lead, Food Security and Agritech, Professor,
Department of Biotechnology, Guru Nanak Dev University

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Professor, Université Laval

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Professor, The University of British Columbia

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Masters of Applied Science Student, The University of British Columbia

Shashank Chandra
Event Coordinator – India
PhD Student, Indian Institute of Technology, Roorkee

Jaskaran Dhiman
Outreach and Alumni Coordinator
Postdoctoral fellow, McGill University

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Co-Chair & Graduate Seminar Coordinator
PhD Candidate, The University of British Columbia

Abhishek Dutta
Graduate Seminar Coordinator
PhD Student, The University of British Columbia

Karl Zimmermann
Webinar Coordinator
PhD Student, The University of British Columbia

FUNDED RESEARCH PROJECTS

PUBLIC HEALTH

A High-Quality Serotype Discriminating Dengue Virus Diagnostic Test Adapted for Field Investigation

Canadian Lead: Dr. Sachdev Sidhu, The University of Toronto
Indian Lead: Dr. Amitabha Chaudhuri, SciGenom Labs

A Point-of-Care Device for Malaria Diagnosis And Drug Resistance Genotyping

Canadian Lead: Dr. Stephanie Yanow, The University of Alberta
Indian Lead: Dr. Aparup Das, National Institute of Malaria Research

A Portable Fever Kit for Dengue and Chikungunya

Canadian Lead: Dr. Stewart Aitchison, The University of Toronto
Indian Lead: Dr. Manoj Varma, Indian Institute of Science

Agent-Based Simulation of COVID-19: Estimating the Spread and Disease Burden using Advanced Epidemiological Modelling

Canadian Lead: Dr. Raja Sengupta, McGill University
Indian Lead: Dr. Deepak Saxena, Indian Institute of Public Health, Gandhinaga

Citizen-lead Evaluation of the Public Health Response to COVID-19 in India: Harnessing Information and Communications Technology (ICT) to Promote Real-Time learning, Human Rights and Good Governance

Canadian Lead: Dr. Mira Johri, Université de Montréal
Indian Lead: Dr. Aaditeshwar Seth, Indian Institute of Technology, Delhi

COPE: Community Health Outcomes and Personalized Education/Exercises for Spinal Injured Individuals

Canadian Lead: Dr. Andrei Krassioukov, The University of British Columbia
Indian Lead: Dr. Nishu Tyagi, Indian Spinal Injuries Centre

Design2Impact: Uniting Researchers, Makers and Spinal Injury Survivors Through Open-Source Technology

Canadian Leads: Dr. Aaron Yurkewich, The University of Toronto, and Stewart Russell, Makers Making Change at Neil Squire Society

Development of a Hand-Held Molecular Point-Of-Care Test Device for Infectious Diseases

Canadian Lead: Dr. James Mahony, McMaster University
Indian Lead: Dr. Daman Saluja, The University of Delhi

Development of a Portable Device for Early Detection of Eye Infection and Dry Eye Disease

Canadian Lead: Dr. James Feng, The University of British Columbia
Indian Lead: Dr. Ashutosh Richhariya, L.V. Prasad Eye Institute

Development of Portable Spine MEG Scanner for Real-Time Spinal Functional Evaluation and Data Acquisition

Canadian Lead: Dr. Teresa Cheung, Simon Fraser University,
Indian Lead: Dr. Rohit Sharma, Indian Institute of Technology, Ropar

Development of Wearable Artificial Muscle for a Tetraplegic Hand

Indian Leads: Dr. Harvinder Chhabra, Indian Spinal Injuries Centre, India and Dr. Sitikantha Roy, Indian Institute of Technology, Delhi

Dialled In: Tapping Community Voice to Improve Child Immunization Services in India

Canadian Lead: Dr. Mira Johri, Université de Montréal
Indian Lead: Dr. Alok Kumar Mathur, Indian Institute of Health Management Research (IIHMR) University

Engaging Community Pharmacists in India to Enhance Early Detection of Tuberculosis

Canadian Lead: Dr. Madhukar Pai, McGill University
Indian Lead: Dr. Nita Jha, World Health Partners

Identification of High Affinity Ligands Against Dengue Virus NS1 for the Development of an Affordable Point-of-Care Diagnostic Kit

Canadian Lead: Dr. Tom Hobman, The University of Alberta
Indian Lead: Dr. Easwaran Sreekumar, Rajiv Gandhi Centre for Biotechnology

Intelligent Portable Ultrasound Imaging-Based Continuous Lung and Heart Monitoring System for Post-COVID19 Assessment

Canadian Lead: Dr. Abhilash Rakkunedeth Hareendranathan, University of Alberta
Indian Lead: Dr. Mahesh Raveendranatha Panicker, Indian Institute of Technology, Palakkad

Next Generation Molecular Diagnostics for Emerging Viral Diseases

Canadian Lead: Dr. Francois Jean, The University of British Columbia
Indian Lead: Dr. Santanu Chattopadhyay, Nationwide the Family Doctors

Smart App-Based Rapid Multiplex Screening of HIV Associated Co-Infections of at Risk Populations at the Point-of-Care: A Demonstration Study in India

Canadian Lead: Dr. Nitika Pant Pai, McGill University
Indian Lead: Dr. Suma Nair, Manipal Academy of Higher Education

Surface Modulation of CuS Quantum Dots using Biginelli Compounds for Construction of a Portable Fluorescence Sensor for Bacteria

Canadian Lead: Dr. Jan J. Dubowski, Université de Sherbrooke
Indian Lead: Dr. Narinder Singh, Indian Institute of Technology, Ropar

Wearable Technology to Monitor Sitting Posture and Reduce the Pressure Injury Risk

Canadian Lead: Dr. Hossein Rouhani, The University of Alberta

FUNDED RESEARCH PROJECTS

FOOD SECURITY AND AGRITECH

An Ultra-Sensitive Plant-Care Monitoring System with Quantitative and Real-Time Data Analysis
Canadian Lead: Dr. Nazir Kherani, University of Toronto
Indian Lead: Dr. Prashant Mishra, Indian Institute of Technology, Delhi

Exploration of an Intra- and Inter-National Blockchain-Powered and Physical Internet-Enabled Food Supply Chain Traceability System in Canada and India
Canadian Lead: Dr. Eric Li, University of British Columbia (Okanagan)
Indian Lead: Dr. Mansi Babbar, University of Delhi

Extraction of Protein from Brewer's Spent Grain for Human and Animal Consumption
Canadian Lead: Dr. Chijioke Emenike, Dalhousie University and
Indian Lead: Dr. Kiran Babu Uppuluri, SASTRA Deemed University

Food Security and the Problem of Fit: Examining Local Innovations to Milk Wastage in India
Canadian Lead: Dr. Jeremy Pittman of University, Waterloo
Indian Lead: Dr. Sanchayan Nath, Indian Institute of Technology, Tirupati

Irrigation Scheduling Using Model-Based Reinforcement Learning for Stochastic Differential Equation Control
Canadian Lead: Dr. Chi-Guhn Lee, University of Toronto
Indian Lead: Dr. Subimal Ghosh, Indian Institute of Technology, Bombay

Methylotrophs Driven Bioconversion of C1 Compounds to Carotenoids for Mitigation of Greenhouse Gas, Enhancing Nutrient Uptake and Alleviation of UV Radiation Stress in Agriculture
Canadian Lead: Dr. Sina Adl, University of Saskatchewan
Indian Lead: Dr. Santosh Mohanty, Indian Institute of Soil Science

Trash is Cash – Turning Unmerchantable Crop and Forest Residues into High-Value, Carbon-Negative Fertilizers for Regenerative Farming in Rural Communities
Canadian Lead: Dr. Anthony Lau, The University of British Columbia
Indian Lead: Dr. Sonal Thengane, Indian Institute of Technology, Roorkee

Understanding and Exploiting the Role of Eukaryotic Energy Sensor TOR Kinase in Enhancing Thermotolerance and Drought Resistance in Model and Crop Plants
Canadian Lead: Dr. Leon Kochian, University of Saskatchewan
Indian Lead: Dr. Ashverya Laxmi, National Institute of Plant Genome Research

Variable Rate Application of Nutrients by Developing Nutrient Estimation Sensor and Precision Spraying Mechanism
Canadian Lead: Dr. Ahmad Al-Mallahi, Dalhousie University
Indian Lead: Dr. Narasimha Murthy, Indian Institute of Technology, Tirupati

A Floating Treatment Wetland System for Removing Contaminants from Rivers and Streams using a Biomimicry Approach
Canadian Lead: Dr. Shiv Prasher, McGill University
Indian Lead: Dr. Ramesh Kanwar, Lovely Professional University

A High-Performance Advanced Septic (HPAS) System for Villages and Roadside Restaurants
Canadian Lead: Dr. Edward McBean, The University of Guelph
Indian Lead: Dr. Y. R. Satyaji Rao, National Institute of Hydrology

A Nanotechnology Enabled Device for the Detection of Harmful Bacteria in Drinking Water
Canadian Lead: Dr. Michael Serpe, The University of Alberta
Indian Lead: Dr. Soumyo Mukherji, Indian Institute of Technology, Bombay

A Study of Technology and Financial Appropriateness of Water and Wastewater Infrastructure in Selected Cities of India
Canadian Lead: Dr. Govind Gopakumar, Concordia University
Indian Lead: Dr. N.C. Narayanan, Indian Institute of Technology, Bombay

An Innovative Green Technology for Treating Municipal and Industrial Wastewater Entering Rivers and Streams
Canadian Lead: Dr. Shiv Prasher, McGill University
Indian Lead: Dr. Rameshwar Kanwar, Lovely Professional University

An Innovative Sustainable Biotechnology for Resource Recovery from Wastewater Streams using Microwave Enhanced Advanced Oxidation with Algae
Canadian Lead: Dr. Victor Lo, The University of British Columbia
Indian Lead: Dr. Pradeep Kumar, Indian Institute of Technology, Roorkee

Application of Emerging Biotechnology for Non-point Source Pollution Control of River Ganga, India
Canadian Lead: Dr. Onita Basu, Carleton University
Indian Lead: Dr. Anirban Gupta, IEST Shibpur

INTEGRATED WATER MANAGEMENT

Biovalorization of Lignin
Canadian Lead: Dr. Vikramaditya G. Yadav, The University of British Columbia
Indian Lead: Dr. Syed S. Yazdani, International Centre for Genetic Engineering and Biotechnology

Biomonitoring of Water Quality in Relation to Human Health Using Biosensors and Improvements through Nanoparticle-Based Purification Systems
Canadian Lead: Dr. Damase P. Khasa, Université Laval
Indian Lead: Dr. Manzoor Shah, The University of Kashmir

Climate Change Impacts on the Riverine Thermal and Flow Environments Under Diverse Climates of India and Canada
Canadian Lead: Dr. Taha Ouarda, INRS
Indian Lead: Dr. Shaik Rehana, International Institute of Information Technology, Hyderabad

Compact High-Rate Water Treatment Systems for Small Communities
Canadian Lead: Dr. Ramin Farnood, The University of Toronto
Indian Lead: Dr. Vivek Kumar, Indian Institute of Technology, Roorkee

Contaminated Land Reclamation Using Hybrid Absorbable Landscape and Native Plant Species
Canadian Lead: Dr. Rishi Gupta, The University of Victoria
Indian Lead: Dr. Neeta Raj Sharma, Lovely Professional University

Development of A Low-Cost Water Monitoring Kit for Multiplex Heavy Metal Detection Based on Aptamer Sensors
Canadian Lead: Dr. David Juncker, McGill University
Indian Lead: Dr. Rohit Srivastava, Indian Institute of Technology, Bombay

Development of an ICT Platform for Water Quality Monitoring
Canadian Lead: Dr. Clarence de Silva, The University of British Columbia
Indian Lead: Dr. Sandhya Shrivastava, Bhavan's Research Centre, Mumbai University

FUNDED RESEARCH PROJECTS

INTEGRATED WATER MANAGEMENT

Development and Scale-Up of Technology for Microbial Extraction of Xylose from Agro-Waste Materials and Subsequent Conversion into Xylitol
Canadian Lead: Dr. Tatjana Stevanovic, Université Laval
Indian Lead: Dr. Baljinder Kuar, Punjabi University

Development of Capacitive Deionization Technology for Point-of-Use Water Purification
Canadian Lead: Dr. Madjid Mohseni, The University of British Columbia
Indian Lead: Dr. Sathish Kumar, Eureka Forbes Ltd.

Direct Cryptosporidium Detection for Developed and Developing Nations
Canadian Lead: Dr. Mina Hoorfar, The University of British Columbia
Indian Lead: Dr. Krishna Khairnar, CSIR – National Environmental Engineering Research Institute

GBM-CLIMPACT: Development of an End-to-End Modeling and Analysis Toolset to Assess Climate Impact and Readiness of Water Sector in the Ganga, Brahmaputra, and Meghna Basins
Canadian Lead: Dr. Martyn Clark, University of Saskatchewan
Indian Lead: Dr. Manabendra Saharia, Indian Institute of Technology, Delhi

Handheld P-Laps Pathogen Detector
Canadian Lead: Dr. Thomas Thundat, The University of Alberta
Indian Lead: Dr. Bhaskaran Muralidharan, Indian Institute of Technology, Bombay

High Quality Potable Water for Small/Remote Communities in Canada And India
Canadian Lead: Dr. Pierre Bérubé, The University of British Columbia
Indian Lead: Dr. Anand Krishnamurthy, GE India

Machine Learning Methods for Water Quality Estimation and Control in Water Resource Recovery Facilities: Towards Circular Economy and Sustainability
Canadian Lead: Dr. Peter Vanrolleghem, Université Laval
Indian Lead: Dr. Seshagiri Rao Ambati, Indian Institute of Petroleum and Energy (IIPE)

Microfabricated, Low-Cost, High-Sensitivity Chlorine and PH Sensor Systems for Water Quality Monitoring
Canadian Lead: Dr. Jamal Deen, McMaster University

Next Generation Epidemiological Models for Accurate Predictions of Future Pandemic Waves: Integrating Sewer Simulations with Public Health Information using Machine-Learning Algorithms
Canadian Lead: Dr. Ajay Ray, Western University
Indian Lead: Dr. Sridharakumar Narasimhan, Indian Institute of Technology, Madras

Passive UF Membrane Demonstration
Canadian Lead: Dr. Pierre Bérubé, The University of British Columbia

Phosphorous Recovery from Wastewater for Safeguarding Global Phosphorous Sustainability and Food Security: Denitrifying Phosphorous Accumulating Organisms (DPAOs) Have the Merits
Canadian Lead: Dr. Qiuyan Yuan, University of Manitoba
Indian Lead: Dr. Prangya Ranjan Rout, Thapar Institute of Engineering & Technology

Quantum Dot Solar Panels for Water Treatment In Remote Settings
Canadian Lead: Dr. Edward Sargent, The University of Toronto

Reconfigurable Platform for Rapid Autonomous Quantification of Pathogens in Wastewater using PCB Electrode-Based Assays
Canadian Lead: Dr. Richa Pandey, University of Calgary
Indian Lead: Dr. Siddharth Tallur, Indian Institute of Technology, Bombay

Sensors 4 People / 3 Drops
Canadian Lead: Dr. Michael Serpe, The University of Alberta

Sewage Contaminated Lake Water Quality Restoration through Aeration and Floating Wetland Plants
Canadian Lead: Dr. Rajesh Seth, The University of Windsor
Indian Lead: Dr. Rakesh Kumar, CSIR-NEERI

Testing and Upscaling Phytoremediation Technology in Real-World Conditions
Canadian Lead: Dr. Damase Khasa, Université Laval
Indian Lead: Dr. Manzoor Shah, The University of Kashmir

Thondebhavi Water Quality Assessment
Canadian Lead: Dr. Pierre Bérubé, The University of British Columbia

Thorsby Water Quality Assessment
Canadian Lead: Dr. Michael J. Serpe, The University of Alberta

Understanding the Impact of Climate Change and Land Use Change on the Groundwater Resources in the Future Using Deep Learning Models with Focus on Data Scarce Regions
Canadian Lead: Dr. Jan Franklin Adamowski, McGill University
Indian Lead: Dr. R.Maheswaran Rathinasamy, Indian Institute of Technology, Hyderabad

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SAFE AND SUSTAINABLE INFRASTRUCTURE

A Data-driven Simulation-based Machine Learning Optimisation (SML-Opt) Framework to Support Net Zero Energy Building Retrofits in Canadian and Indian Contexts
Canadian Lead: Dr. Elie Azar, Carleton University
Indian Lead: Dr. Albert Thomas, Institute of Information Technology, Bombay

Application of Precast Products Made Using Bottom Ash and Fly Ash for Rural Pavements and other Infrastructure in India
Canadian Lead: Dr. Rishi Gupta, The University of Victoria
Indian Lead: Dr. Urmil Dave, Institute of Technology, Nirma University

Assessment of Fire Performance of Structural Elements and Structural Systems through Conventional Fire Tests and Hybrid Fire Simulation
Canadian Lead: Dr. Oh-Sung Kwon, The University of Toronto
Indian Lead: Dr. Dipti Ranjan Sahoo, Indian Institute of Technology, Delhi

Blockchain Based Multi-Layer Energy Management System for Smart Buildings
Canadian Lead: Dr. Kankar Bhattacharya, University of Waterloo
Indian Lead: Dr. Rohit Bhakar, Malaviya National Institute of Technology, Jaipur

Carbon Neutrality through Combined CO₂ Capture And Novel H₂ Technology With Production Of Non-Conventional Fuels For Smart Cities
Canadian Lead: Dr. Ibrahim Dincer, Ontario Tech University
Indian Lead: Dr. Subrata Borgohain Gogoi, Dibrugarh University Assam

Characterization and Use Of Industrial Fly Ash
Canadian Lead: Dr. Daman Panesar, The University of Toronto
Indian Lead: Dr. Bhupinder Singh, Indian Institute of Technology, Roorkee

Conservation of Heritage Masonry Structures within Cauvery Basin Waterworks
Canadian Lead: Dr. Vivek Bindiganavile, The University of Alberta
Indian Lead: Dr. Narayana Suresh, National Institute of Engineering

Development of Cost-Effective, Energy-Efficient, and Resilient Housing Technologies for First Nations Communities
Canadian Lead: Dr. Ashutosh Bagchi, Concordia University

Energy and Water Disaggregation for Non-Intrusive Load Monitoring in Buildings
Canadian Lead: Dr. Ivan Bajic, Simon Fraser University
Indian Lead: Dr. Angshul Majumdar, Indraprastha Institute of Information Technology, Delhi

Evaluating the Integrity of Railways Infrastructure in India and Canada with an Emphasis on Bridges and Tracks
Canadian Lead: Dr. Mustafa Gul, The University of Alberta
Indian Lead: Dr. Pradipta Banerji, Indian Institute of Technology, Roorkee

Fire Performance of Aged Reinforced Concrete Structures
Canadian Lead: Dr. Mark F. Green, Queen's University
Indian Lead: Dr. Umesh Kumar Sharma, Indian Institute of Technology, Roorkee

Full Field Non-Contact SHM Protocols for Long Span Railway Bridges and Heritage Structures
Canadian Lead: Dr. Rishi Gupta, The University of Victoria
Indian Lead: Dr. Balasubramanian Esakki, Vel Tech University

Harnessing the Potential of Renewable Energy (Solar / Wind) for Sustainable Building Energy Management through Compressed Air Energy Storage
Canadian Lead: Dr. Fariborz Haghighat, Concordia University
Indian Lead: Dr. V Gayathri, Vellore Institute of Technology

High-Performance Connections for a Tall Indigenous Timber Sculpture
Canadian Lead: Dr. Tony Yang, The University of British Columbia

High Fracture Toughness, Durable Concrete with Minimized Carbon Footprint Employing Large Amounts of Industrial Waste
Canadian Lead: Dr. Nemkumar Banthia, The University of British Columbia

Improving Building Energy Demand Predictions in Smart Cities through Sensor Observations and Considerations of Landscape Characteristics
Canadian Lead: Dr. Fitsum Tariku, British Columbia Institute of Technology
Indian Lead: Dr. Prasad Avinash Pathak, FLAME University

Improving Fire Safety of Structures Through the Development of Fire Retardant Laminated Glass Glazing
Canadian Lead: Dr. Maged Youssef, Western University
Indian Lead: Dr. Ajitanshu Vedrtam, Invertis University

India-Canada Initiative for Resilient Global Urban Shelter
Canadian Lead: Dr. Constantin Christopoulos, The University of Toronto
Indian Lead: Dr. Ravi Sinha, Indian Institute of Technology, Bombay

Innovative Field Demonstration of Sustainable Infrastructure
Canadian Lead: Dr. Shamim Sheikh, The University of Toronto
Indian Lead: Dr. Umesh Kumar Sharma, Indian Institute of Technology, Roorkee

Large Area Microbolometer Uncooled Focal Plane Arrays for Thermal Imaging
Canadian Lead: Dr. Ghassan Jabbour, The University of Ottawa
Indian Lead: Dr. Madhusudan Singh, Indian Institute of Technology, Delhi

Manufacturing Sustainable and Carbon Neutral Steel Structures for Construction Industry using Wire Arc Additive Manufacturing (WAAM): Static, Dynamic and Fatigue Characterization
Canadian Lead: Dr. Philippe Bocher, École de Technologie Supérieure (ÉTS)
Indian Lead: Dr. Lakshmi Narayan Ramasubramanian, Institute of Information Technology, Delhi

Metamaterial Walls for Improved Acoustic Performance in Green Building
Canadian Lead: Dr. Umberto Berardi, Ryerson University
Indian Lead: Dr. Arpan Gupta, Indian Institute of Technology, Mandi

Metawall: Metamaterial Based Lightweight Panel Wall For Enhanced Building Acoustic And Seismic Resistance
Canadian Lead: Dr. Sreekanta Das, The University of Windsor
Indian lead: Dr. Arnab Banerjee, Indian Institute of Technology, Delhi

Mobile App for Improving Survival in Fires Through Efficient Egress: The Role of Impromptu Indoor WiFi Localization and Georeferenced Building Maps
Canadian Lead: Dr. Raja Sengupta, McGill University
Indian Lead: Dr. Ashwin Srinivasan, BITS Pilani KK Birla Goa Campus

Modelling and Assessment of Deficient and Repaired Structures
Canadian Lead: Dr. Frank Vecchio, The University of Toronto
Indian Lead: Dr. Umesh Kumar Sharma, Indian Institute of Technology, Roorkee

Multifunctional Composites and Structural Health Monitoring for Smart Concrete Structures
Canadian Lead: Dr. Martin Noel, University of Ottawa
Indian Lead: Dr. Durai Prabhakaran, Institute of Information Technology, Jammu

FUNDED RESEARCH PROJECTS

SAFE AND SUSTAINABLE INFRASTRUCTURE

Remoulding Existing Buildings into Smart Carbon Neutral Buildings: A Green Cyber Physical Approach (Green-CPS)
Canadian Lead: Dr. Kuljeet Kaur, École de Technologie Supérieure (ÉTS)
Indian Lead: Dr. Mukesh Singh, Thapar Institute of Engineering and Technology (TIET)

Scour Monitoring of an Overwater Bridge in Manitoba Using Dissolved Oxygen (DO) Probes
Canadian Lead: Dr. Faezeh Azhari, The University of Toronto

Smart Sensor Deployment in Buildings: Evacuation Planning and Energy Management
Canadian Lead: Dr. Mark S. Fox, The University of Toronto
Indian Lead: Dr. Krithi Ramamritham, Indian Institute of Technology, Bombay

Solar Energy Powered Net-Zero Energy Smart Buildings
Canadian Lead: Dr. Bruno Lee, Concordia University
Indian Lead: Dr. K. Srinivas Reddy, Indian Institute of Technology, Madras

Structural Health Monitoring of Tall Buildings Using Vibration-Based Techniques
Canadian Lead: Dr. Lucia Tirca, Concordia University
Indian Lead: Dr. S.K. Panigrahi, CSIR-CBRI, Roorkee

Sustainable Infrastructure Using Smart FRPs
Canadian Lead: Dr. Shamim Sheikh, The University of Toronto
Indian Leads: Dr. Umesh Sharma, & Dr. Pradeep Bhargava, Indian Institute of Technology, Roorkee

Sustainable Earthquake-Resistant 3D-Printed Concrete Housing: From Laboratory Testing to Industrial Application
Canadian Lead: Dr. Vahid Sadeghian, Carleton University
Indian Lead: Dr. Biranchi Panda, Institute of Information Technology, Guwahati

Urban Heat Island Effect and Building Energy Demand: Linkages Explained Using a Dense, Low Cost Sensor Network
Canadian Lead: Dr. Raja Sengupta, McGill University
Indian Lead: Dr. Prasad A. Pathak, Shiv Nadar University

Valorization of CO₂ to Fuel over MOFs derived SACs: A Machine Learning Guided Experimental Approach
Canadian Lead: Dr. Ali Seifitokaldani, McGill University
Indian Lead: Dr. Sounak Roy, Birla Institute Technology and Science

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- Black Mountain Irrigation District, Kelowna
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- Canada-India Foundation, Mississauga
- Canada-India Network Society
- Canada-India Parliamentary Friendship Group, Ottawa
- Canada-India Education Society (CIES), Richmond
- Canadian Construction Association
- Canadian Society for Civil Engineering
- Chawathil First Nations Community
- City of Abbotsford JAMES Wastewater Treatment Plant, Abbotsford
- City of Kelowna
- City of Rouyn-Noranda
- Clean Air Partnership, Toronto
- Cree Nation of Wemindji
- District of Lake Country
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- Hupacasath First Nation
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