STEM Research Priorities at Federation University

Society and the Environment
Virtual Digital and Computational Environments

Professor Syed Islam
Associate DVC Research and Innovation

Federation University

FUTURE REGIONS RESEARCH Centre

FRRC

Directors of FRRC

Prof Singarayer Florentine

Prof Keir Reeves

Prof Thomas Baumgartl

Federation University

Centre for New Energy Transition Research

CfNETR

Professor Nima Amjady/ Professor Syed Islam/ Dr Rakib Shah/ Dr Jerry Hu/Dr Savin Chand

Federal Government funded Research Centre ($5.5M in total)

Centre for Smart Analytics

https://federation.edu.au/research/research-centres/csa

Some Key Researchers:

Prof Joarder Kamruzzaman

Prof Adil Baghirov

A/Prof Gour Karmakar

Prof Shyh Wei Teng

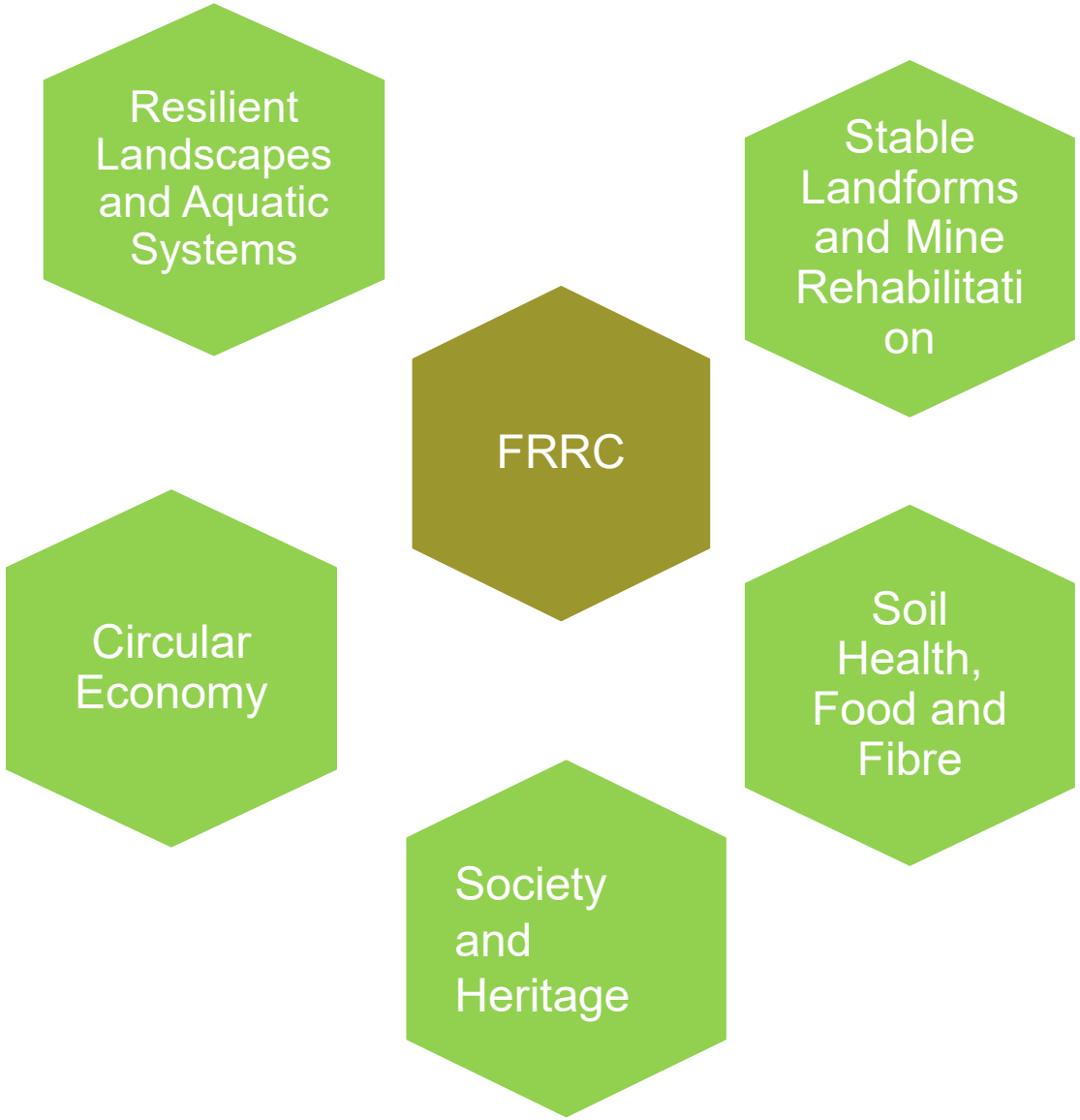
Health Research Priorities at Federation University

Health Innovation Transformation Centre (HITC)
Centre for e- Research and Digital Innovation- CeRDi
Collaborative Evaluation Research Group - CERG

Professor Shane Thomas
Associate DVC Research and Innovation

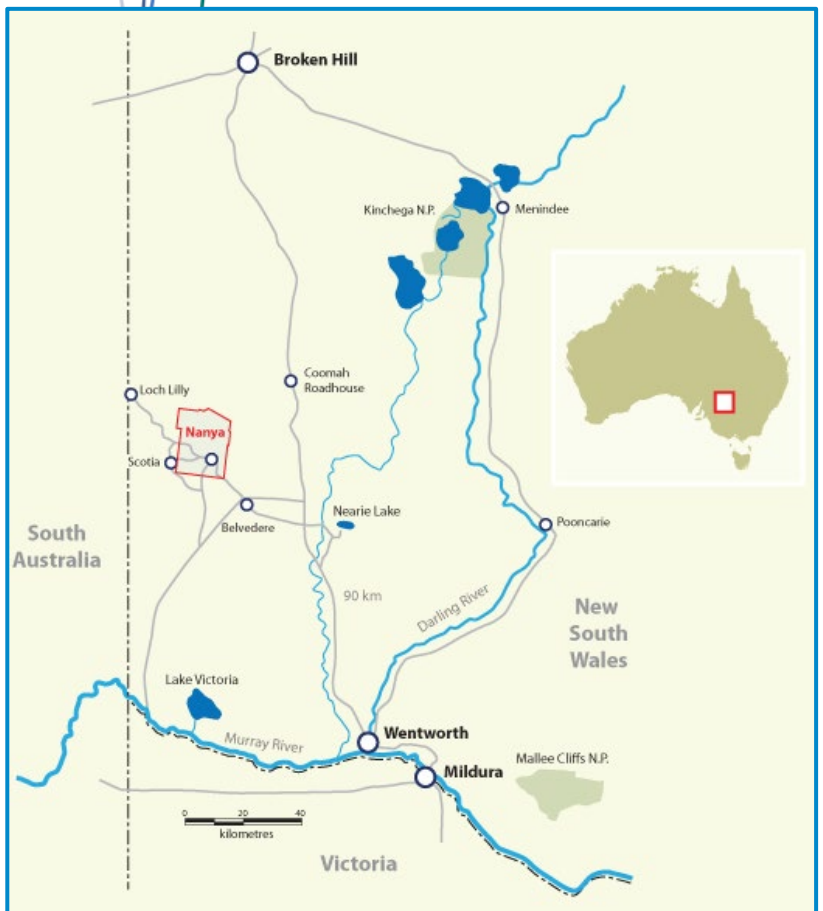
FRRC Research streams

- Resilient Landscapes and Aquatic Systems
- Land Stability and Mine Rehabilitations
- Circular Economy
- Society and Heritage
- Soil, Agriculture, Food and Fibre



Nanya Station, Arid Zone Research Centre

Federation University | FUTURE REGIONS RESEARCH Centre



Nanya Station (40,000ha) under pastoral management 1930 - 2004.

Purchased by University in 2003 for education, research conservation.

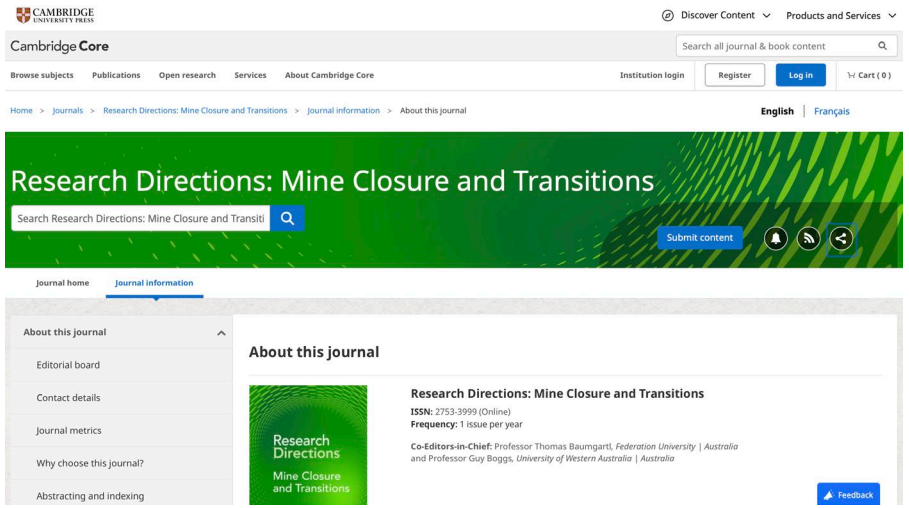
Building a nationally recognised research hub for the study and teaching of biodiversity, protection of fauna and flora, best practice and outcomes of extensive land management and effects of climate change

Researchers with experience in:

- ✓ Urban, restoration and rehabilitation ecology
- ✓ Reliable and sustainable water supply
- ✓ Integrated water management
- ✓ Green-Blue infrastructure i.e. hydrogen
- ✓ Improvement of agricultural practice, drought resilient and sub-soil amelioration
- ✓ Integrated circular economy (Biosolids)
- ✓ Carbon in soils
- ✓ Community consultation and engagement
- ✓ Higher education

FRRC data and achievements 2023:

- Number of members - 70
- Total amount of research grants awarded in 2023: $ 3.1 M
- 3 Research Fellows funded by FRRC
- 43 (Q1) publications out of in total 163 journal publications
- Book publications
- Launching of journal ‘Mine Closure and Transitions’ with CUP with FRRC member one of editors in chief



Professor Syed Islam (Advisor) Centre for New Energy Transition Research

Professor Nima Amjady Director Centre for New Energy Transition Research

Microgrids and Renewables
Theme Leader: Jiefeng Hu

- Smart control of Energy Storage and Microgrids
- Grid integration of renewable energies
- Power electronic converters
- Electrical vehicles Planning and Operation
- Virtual power plant operation and control
- Energy management in smart buildings

Future Grid and Community Energy
Theme Leader: Rakib Shah

- Demand management for ancillary service
- Smart grid security
- Resiliency in the power network
- Prosumer market model
- V2G and V2H – Control and impact assessment
- Optimization of Energy System
- Social license to clean energy project

Future Fuel and Hydrogen Economy
Theme Leader 1: Vincent Verheyen;
Theme Leader 2: S. Sharma

- Production of low emission fuel
- Combine heat and power
- Hydrogen technology for power and transportation system
- Low-cost storage technology
- Bioenergy and energy from waste
- Technical and economical analysis in energy and transport system

Net Zero Initiatives
Theme Leader: Savin Chand

- Water and energy nexus for low carbon society
- Built environment – minimizing environmental impact
- Human behavioral study
- Impacts of climate change on extreme weather events on Energy and Water
- Zero-emission in Transportation

SINETK Labs

1) Power Engineering Simulation Laboratory (ETAP USA co-sponsored)
ETAP, DigSiLent, PSCAD, EMTDC, ANSOFT

2) Emerging Electric Vehicle Laboratory

BYD Atto 3 V2G and G2V and V2L, Battery Energy Storage, Rooftop PV, Wind and PV Simulators, OPAL RT, Amplifiers and Electronic Load Bank

Completion planned in June 2024

HDR Students and Postdocs

- Currently, **16 HDR** students are working in different fields in Power and Energy Systems (three Female HDRs);
- $50 M REACH Trailblazer Universities consortium Member

- Currently **Four postdocs** are working in industry-funded projects;

The centre is expecting 3 **postdoc (from CfNETR and project funding)** and **three** HDR students soon.
Target by the end of the project in September 2025: 30 HDRs and 7 postdocs

Publications in the last two Years

- **56 publications in peer-reviewed Q1 and Q1D1 journals**
- **More than 60 papers and presentations in high-ranked national/international conferences**
- **Target: 20% increase in publications per year.**

Centre director and stream leaders to set targets in respective FoR codes that are identified by RO, and make plans to achieve targets

Ongoing Research Projects

- **Transforming the distribution grid to the virtual power plant, ICT frameworks, tools, and control, ARC Linkage (Syed Islam, 2023-2025 with Curtin and UNSW – originally 2021-2024)**
- **Intelligent Power Inverters for Future Community Microgrids, Trailblazer University Consortium, (Syed Islam, Jiefeng Hu, 2023-2026)**
- **Use and recycling of Potassium in the production of advanced carbon products (Vincent Verheyen, Surbhi Sharma., Alicia Reynolds, 2022-2024)**
- **Agricultural waste to Energy, Recycling Victoria R&D Fund, GAIE/Gekko, (Rakibuzzaman Shah and Syed Islam, 2022-2023)**
- **CSIRO – Climate Information Services for Resilient Development in Vanuatu, $125,000 (Savin Chand, 2022-2023)**
- **NESP Project 2.5 – Regional climate change guidance for local action, $113,156 (Savin Chand, 2022-2023)**

Ongoing Research Projects

- **CSIRO – Climate Information Services for Resilient Development in Vanuatu, $50,000 (Savin Chand, 2022-2023, extension).**
- **NESP Project 2.5 – Regional climate change guidance for local action, $101,042 (Savin Chand, 2023-2024, extension).**
- **Enhanced System Planning (ESP): Modelling and assessment of integrated system performance through DSO-TSO steady-state model of aggregated DER as an active entity, $300,000, Investigators: Rakibuzzaman Shah, Nima Amjady, Syed Islam, Source of Support: Centre for New Energy Technologies Ltd (C4NET), Fund Scheme: C4NET Flagship Program.**
- **Project Title: Wimmera, Mallee, and Northwest Energy Demand Mapping, $119,500, Investigators: Rakibuzzaman Shah, Nima Amjady, Syed Islam, Source of Support: Department of Energy, Environment and Climate Action (DEECA), Fund Scheme: 2023 Grampians Energy Transition Grants.**
- **Project Title: Bi-level Uncertainty-aware DER Aggregation Planning with Electrical Transportation, Renewable Resources, and Community Batteries, $222,413, FedUni Investigators (it is an international grant): Nima Amjady (Lead FedUni Investigator), Rakibuzzaman Shah, Syed Islam, Madhu Chetty, Source of Support: Qatar Government, Fund Scheme: Qatar National Research Fund.**

CSA Members

Members	Members: 35
	Associate members: 15
	PhD students: 60+
External members	19 from Australian and Overseas universities
	11 Overseas members include academics from reputed universities in Europe, USA, China, Vietnam
Reputation	One member and one associate member are on the ARC College of Experts panel

Major current engagements

- **FedUni – IBM IoT Watson Lab**
  - provides avenue to collaborate with IBM and engage with local industries, communities, government organizations
- **City of Casey/Ballarat/LaTrobe**
  - iSenseLab (Berwick) & IoT lab, Mechatronics lab (Gippsland), VR/AR lab (Mt Helen) are nicely positioned to strengthen this engagement further, directly contributing to community, business and education
- **Utility Companies**
  - ML, Optimization, IoT, supply chain can bring significant innovation and productivity boost
- **ICSL -** has long term industry partnership, engagement with Westpac Bank, Defence Science Institute

- **Other Partners**

Soil CRC – 4 PhDs

CSIRO – 2PhDs

DAWE

MaxiTRANS Industries https://www.maxitrans.com/

FMP Group (Australia) Pty Ltd

https://www.bendix.com.au/

Dasma Environmental Industries Pty Ltd

https://www.dasma.com.au/dasma-environmental/

Department of Transport https://transport.vic.gov.au/

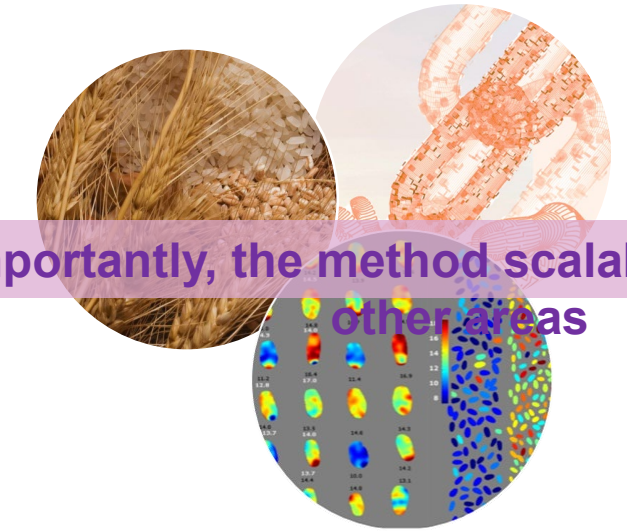
PF Olsen Australia https://au.pfolsen.com/

- **Emerging Partners**
  - Agriculture Victoria – 2 PhDs
  - Bulmer Farms – 1 PhD
  - Matter IO Pty, Victoria – 1 PhD
  - Techplus Ltd – 1 PhD

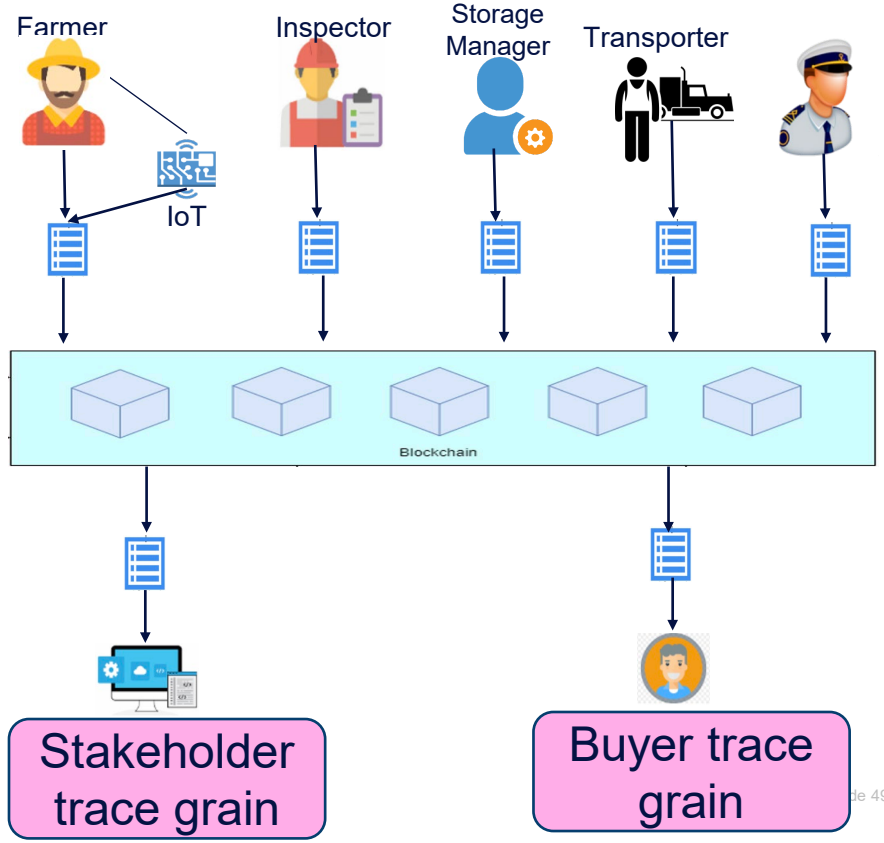
Federation University

End-to-end Traceability in Australian Grain Export Supply Chain

- Australian grain export is facing growing competition internationally
- Conventional method of grain quality assessment is extremely challenging
- We are developing a prototype for an end-to-end traceability solution using ML, computer vision & blockchain technology
  - **fast, inexpensive, accurate, robust, non-destructive, secured**



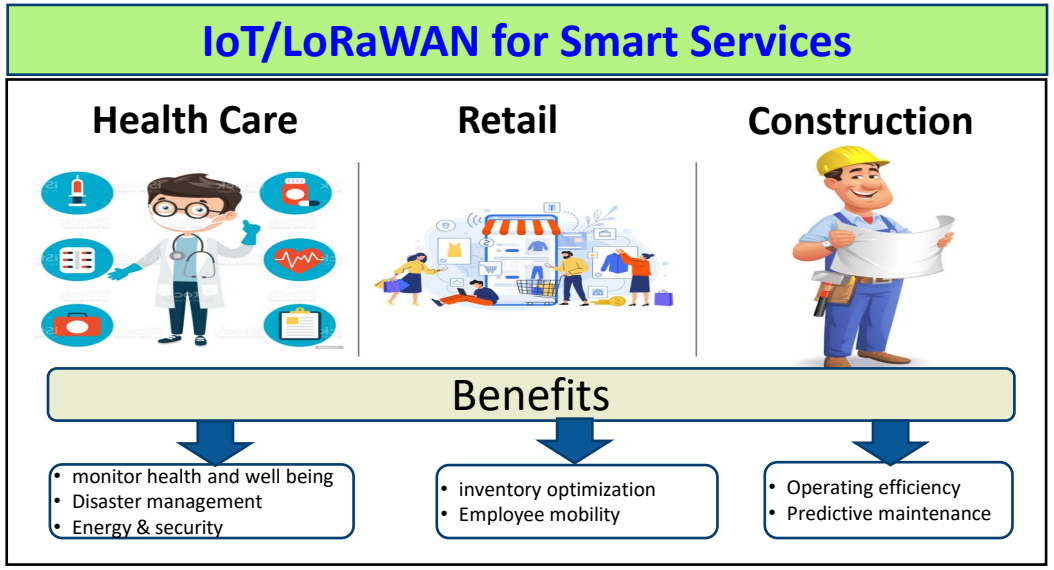
Mostly importantly, the method scalable and transferable to other areas



Federation University

City of Casey – A Smart City

- One of Victoria's largest municipalities
- We are key partner to test, trial & research smart city technology across Casey
- Provide **though leadership**
- Co-creating a **Living Lab**



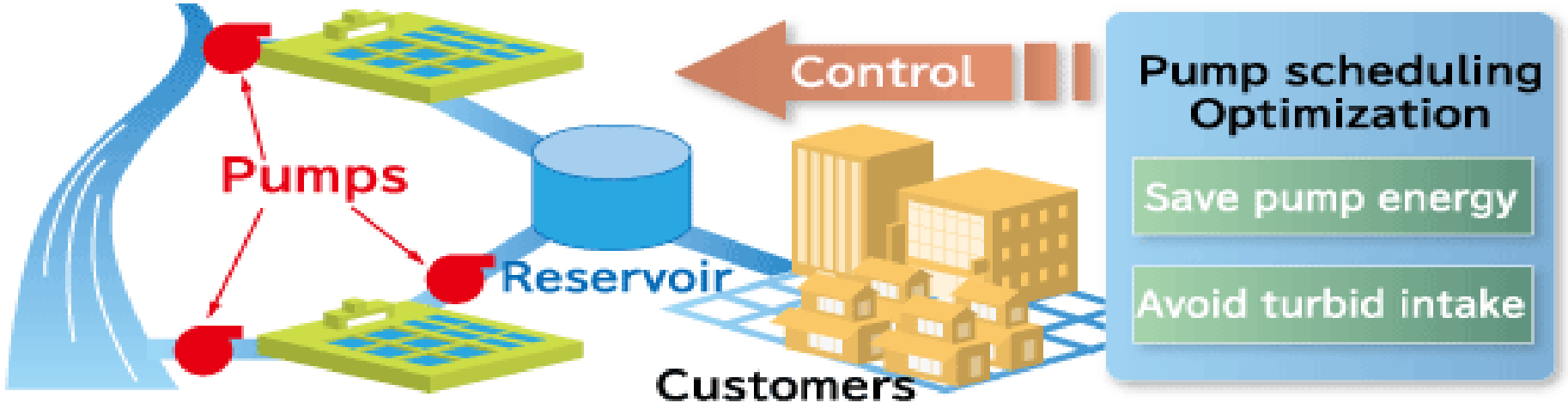
AI BMX

- Used of **AI & video data analysis** to detect in real time **illegal vehicles** accessing BMX track
- Assist Council officers for **decision making**

Federation University

Optimisation of water distribution systems

Pump scheduling is one of the most important tasks of the operation of a water distribution system as it represents the major part of its operating costs (electrical energy)



The **Optimal Pump Scheduling** module allows for computing the most economical and efficient way of operating complex water distribution systems with multiple pumps

GuS Military Version

Improving safety for bus passengers using wheelchairs and mobility scooters: Effectiveness of restraint systems

Figure 8. McHarry's Bus Line, Route 40

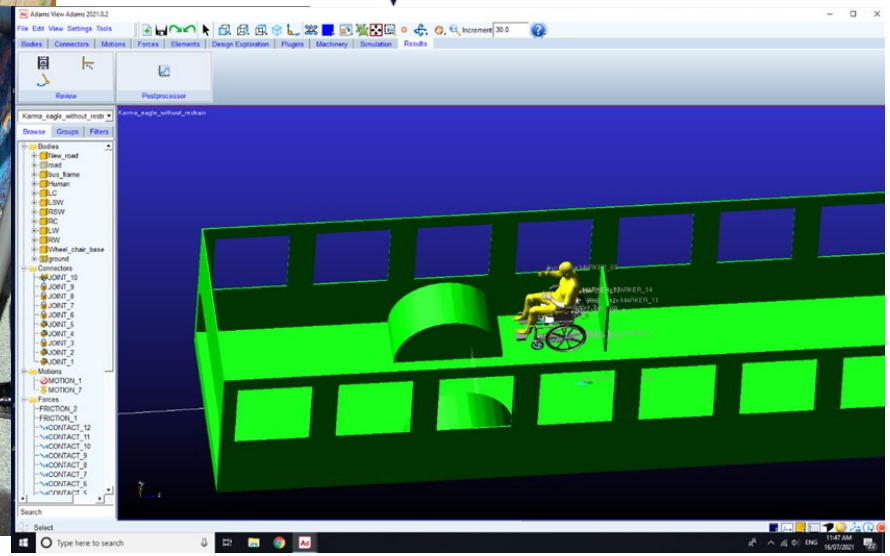


Figure 9 – Bus platform

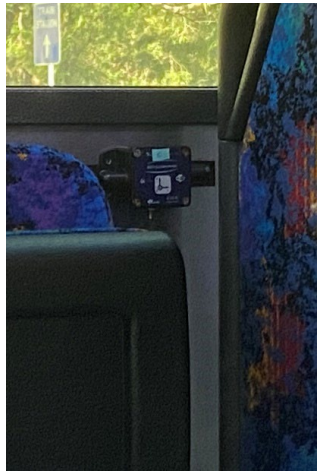
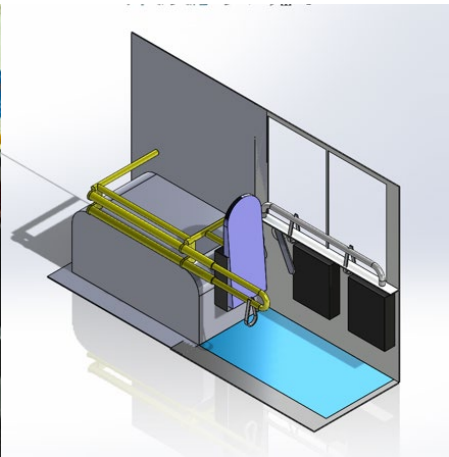


Figure 10 – Bus wall. Lateral view

Figure 11 – Wheelchair arm. Lateral view

Figure26. Mobility device models re-built in SOLIDWORKS.



Thank you

Questions?

Federation University