Paris Session 2022

Digital substations: benefits of drones and robotics

SC B3 PS 3 Question 1

What are the benefits of digital solutions like IoT-sensors, machine learning, artificial intelligence, drones, robots etc. for substation life cycle from planning to maintenance? Which measures are necessary to increase the acceptance of intelligent IoT-based power equipment in substations?

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TRANSPOWER

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Transpower robot and drone development

- Started investigating drones and robots in 2013
- Robots developed to target first response and general inspection
- Member of WG B3.47 to produce B3 TB 807
- Drones for conductor inspection combined with AI for corrosion management targeting a conductor Opex reduction of NZ$500m
- Drone inspection of conductors at Extended line of site (1-5km). Condition Assessment inspection of all towers now primarily by drone rather than climbing
- Developing live-line drone applied joint resistance tester
- H&S benefits gained

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Realised benefits of Transpower substation robot deployment

CB 172 SF6 Leak Management
Robot enabled bi-weekly checks of leaking breaker density gauge, providing critical assurance while we planned complex bus changes to enable repairs.

Saving 6 hrs, 340 km NZ$1.8k, 76 kg CO2 per trip
= 144 hrs, 8160 km, NZ$43k = 1.8 Tonne CO2 in total

Provides fault response and incident investigation time <15min, realising a saving of NZ$250k

- Minimises Critical Risks – driving and fatigue, working alone, inspecting equipment 'in distress'
- Genesis currently providing emergency switching response for Eastland Feeders, NZ$70k p.a. cost

Site design inputs and verification from the comfort of the office

- Saving flights, 36 staff hrs, NZ$5.4k labour, NZ$1.4k transport cost = 290 kg CO2 per trip.

Access road between Napier and Tūai can be closed with multiple hazards/slips – robot advantage

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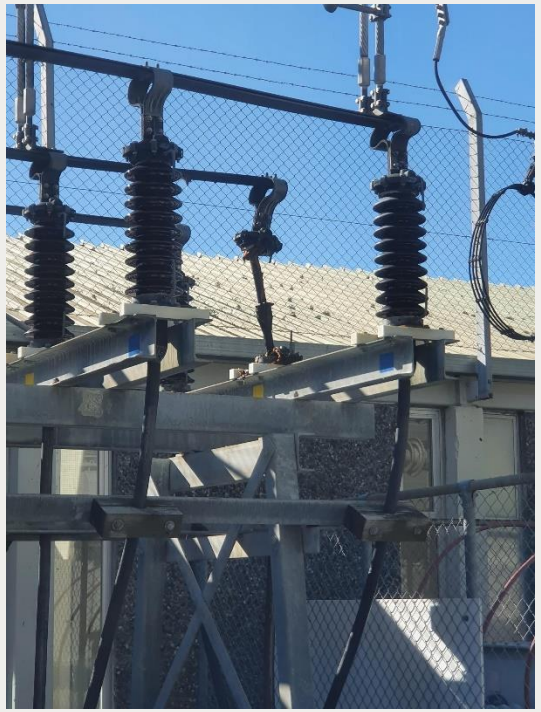
Performance and Value

- Working with the Massey University Automation Laboratory, a stable and robust robotic platform has been achieved over the course of 5 years.
- TUAI an excellent candidate for remote switching utilising disconnecting circuit breakers (DCB's) operated by the NGOC. Based on performance to date, the robot can provide a robust visual confirmation of equipment statuses to support this opportunity.
- Our engineers can remotely interrogate site relays following fault events. Combined with the high-definition visual information provided by the robot, we can better inform our maintenance response with the provided intelligence.
- Place the robot, and not our people in harms way when attending fault events and failed equipment to assess the situation



GFD Cable Sealing End Failure – sending in staff to inspect similar remaining in-service assets for damage

TUI CB172 SF6 Gauge – Image taken by robot, operated by Ventia contracting staff from Napier

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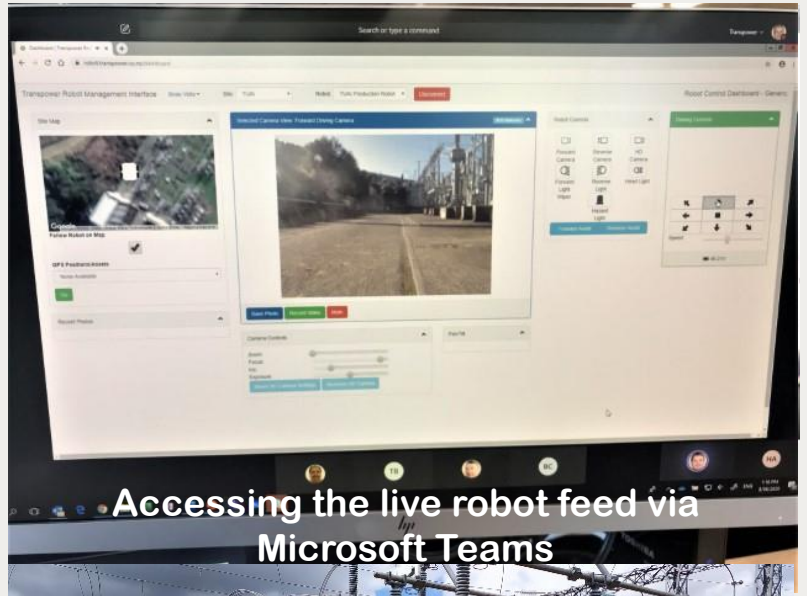
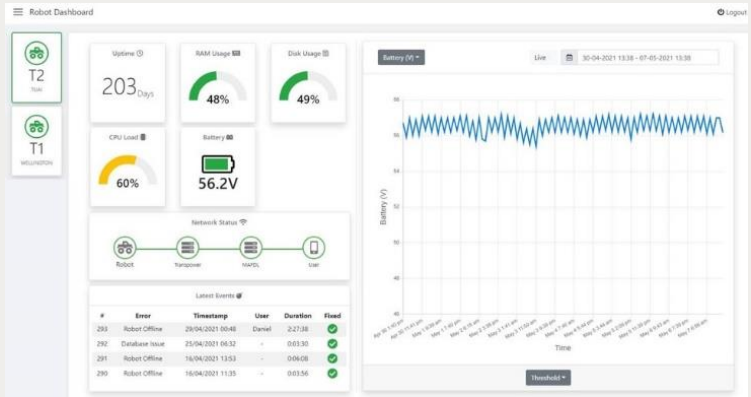
Future opportunities

- The platform has significant scope to support a greater range of packages. This could be in the form of acoustic / thermovision cameras, GPS ‘missions’ (asset locations identified and preconfigured viewing positions supported by auto navigation including auto parking and charging capabilities)
- Missions can include regular station inspections and pre/post maintenance checks. Implementation of machine learning, feeding data into our Asset Works Plan and better informing our investment decisions
- Planned outage risk management, through the identification of defects or conditions that might affect security
- Quality assurance, proving an interface into our engineering groups when carrying out repair activities on the Grid.





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