

## **FAQS: Karetao Hangarau-a-Mahi: Adaptive learning robots to complement the human workforce**

**October 2017.**

### **How does the planned research and outcomes align with the Science for Technological Innovation (SfTI) National Science Challenge?**

The project focusses on SfTI's *Sensors, Robotics and Automation* theme; it will examine, taking a long-term view, how robotics could provide solutions for New Zealand's economic needs.

Specifically, the programme will look into automated and autonomous technologies for small scale, high value, production; delve into "learning" robots; and how robots can operate in rugged outdoor environments.

Researchers will seek to develop new paradigms in robot autonomy and adaptability, including predictive environmental sensor fusion, and automatic improvement of AI-based interpretation of data.

The research group will also investigate instead of developing isolated robots to solve single tasks, workforce robots that could 'communicate', learn, and collaboratively work alongside humans. The programme will investigate 'non-written cues', and the use of icons to communicate and exchange information.

Through active participation of Māori-owned companies the research will also contribute to SfTI's *Vision Mātauranga* theme.

### **How much is the project funded for and for how long?**

SfTI granted \$2 million towards this two year research programme. It will run from 1 July 2017 till 30 June 2019.

### **What is the aim of the project?**

The aim is to provide new knowledge, methods, and tools by investigating new and not yet available robot technologies for future businesses, including how -

- robots can best sense varied environments and analyse resultant data to dynamically derive an interpreted representation of the environment that facilitates robot autonomy
- a quasi 'self-learning' capability can enable quick adaption of robots to new production processes
- robots can share their interpretation of their environment and learned interpretation of tasks/actions with humans - and other robots – now and in the future
- to ensure flexible functionality of workforce robots and maintain safe behaviour in changing and harsh environments.

### **Why is this research project needed?**

There's a need to take a long-term view to provide solutions for specific needs of the New Zealand's economy in the decades to come, including:

- designing robust, highly adaptable field robots to cope with harsh outdoor environments
- providing unique solutions to make New Zealand industries globally compatible when manufacturing or producing on small scale for specific markets of high value produce with cost effective robot technologies
- creating an international hub for New Zealand robotics development with special focus on *workforce robots* that are to a some degree 'self-learning'.

### **How will this project achieve its aims?**

The project's principal investigators will build skills and knowledge through collaborative research on jointly defined tasks. Cross-disciplinary skills in sensing, artificial intelligence, computer graphics, and robotics across seven organisations will be utilised during the project.

### **What benefits is New Zealand likely to see from the project?**

The collaborative structure of this research project across academic, commercial and industrial manufacturing sectors will create a dynamic network of information and expertise that will generate new knowledge, skills and revenue.

From a commercial perspective the primary sector, including agriculture, horticulture, aquaculture and forestry, will directly benefit from the introduction of highly adaptable robots. Robust robots can assist in pre- and post-harvest processes eg cropping, pruning, monitoring nutrients in run off and leaching, and manage environmental inputs like precision agriculture and nutrient management.

Benefits would likely flow onto businesses involved in this programme, including Māori organisations with invested interests in primary production.

### **Which research partners are involved in the project?**

Researchers from SCION, Lincoln Agritech, and Massey, Auckland, Canterbury, Otago, and Victoria Universities will work on the project.

In addition to academic researchers, an Industrial Advisory Committee named 'Te Taumata' will be formed to include individuals from leading commercial industries, Māori organisations and Government stakeholders.

### **What skills will the research partners bring to the project?**

Examples include computer vision, conventional and neural network methods, safety concepts, applied artificial intelligence methods, and pattern recognition.

### **Will New Zealand's research and academic communities benefit from the project?**

This programme aims to build skills and knowledge through collaborative research on jointly defined tasks. The intersection of cross-disciplinary capabilities in robotics R&D will build synergistic designs and contribute to the development of new methods, tools and knowledge advancement.

PhD students on the project will be able to advance their knowledge and gain an understanding of the needs of commercial industries and Māori stakeholders, as well as the potentials of the research organisations.

This programme also aims to develop young Māori researchers, specifically those interested in engineering and computer science.

**How else will the project align with SftI's Vision Mātauranga framework?**

Aspects of Māori culture will be interweaved throughout the development of this programme with guidance from the Industrial Advisory Committee. In particular, this research programme will investigate the concept of *whanau* - instead of isolated robots being developed to solve single tasks, workforce robots will learn and work collaboratively in groups and with humans. Additionally, the programme will investigate Māori communication concepts based on non-written information exchange using icons.

The programme will continue to collaborate with Māori organisations and companies, particularly those with interests in horticultural, dairy and aquaculture robotics and precision agriculture, to deliver indigenous innovation.

**Who will lead the project?**

Armin Werner (Lincoln Agritech), Will Browne (Victoria University), and Johan Potgieter (Massey University) will share the Principal Investigator role. The leads will work alongside Government funding agencies, business owners and stakeholders from robot manufacturers, primary products, food industries and local iwi.