New Student Researchers

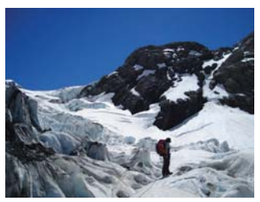
Students in WRC often find themselves at the core of basic research investigations. When the project is finished, the beneficial outcomes are not limited to the new technology, or the working relationship between academic researchers and industrial engineers – but also the students themselves.

When they reach the end of their chosen project they have learned, contributed to and developed sophisticated techniques, and are often ready for employment. In addition to the students mentioned elsewhere in this newsletter, WRC is pleased to have on board:

Alex Opie, a University of Canterbury Bachelor's student in Electrical and Computer Engineering, working on tracking filters for radio receivers and their implementation in FPGA.

Dave Manning, a University of Canterbury Master's student in Electrical and Computer Engineering, and Tait Electronics Ltd Research Fellowship recipient. Dave is working on characterising radio relay channels for new designs.

Student Profile



If you saw Dave Manning at his workstation, you'd be forgiven for thinking that his biggest challenge was interpreting mathematical algorithms and modelling systems. However, one glimpse at the desktop image behind all the MatLab windows gives a glimpse at his other persona.

Dave grew up in Wellington, but from the age of 10 swapped home comforts for trips north to a woolshed and the rock climbing opportunities that the Waikato has to offer.

In 2006, Dave ventured south to study Engineering at the University of Canterbury, and inspired by the views of the southern alps joined the University's Tramping Club and set about exploring the towering peaks running down the length of the South Island.

"my most memorable climb was also my most challenging. In November 07 I completed a solo ascent of Caroline Face, the first time I had attempted any ascent of Mount Cook. The round trip took 3 days, with 18 hours on the face. My first night was spent listening to ice avalanches which seemed to go off every 30minutes - and knew my first challenge would be climbing around them when I started the ascent. I reached the summit on the second day, but that was also the day my cooker stopped working and my last drink! The view from the top was amazing and well worth all the extra effort - climbing up is definitely the best bit!"

Dave enjoys climbing with friends and being an instructor with the club, sharing his experience and expertise. "it is less scary when you can laugh with someone else about the close calls, and great to introduce other people to the mountains - but solo climbing is also good as you can push as hard as you want to and only have your schedule to worry about."

The next challenge for Dave is to ski off the top of Mount Arrowsmith - not content with just the descent, he and his ski buddy are climbing up too! The hike up should take them 8 hours, with an hours' ski down and a 5 hour tramp out. "I've concentrated on skiing this winter - it is much easier than walking in the snow!!"

Related Events

2nd November 2009 - PlanetLab Workshop

ECE Department Seminar Room, University of Canterbury, School of Engineering, Christchurch

This one-day PlanetLab Workshop is funded by a REANNZ grant. Professor Akihiro Nakao from Tokyo, who is active in PlanetLab Japan, is the keynote speaker. PlanetLab was initially a testbed for future internet research (established in 2002) and there are now wireless offshoots in the US and Europe.

IEEE Distinguished Lectures

18th November 2009 - Trends of Next Generation Network and Its Issues (time and room tbc)

The concepts and architecture of the Next Generation Networks (NGN), the current status of commercial implementation and the global evolution will be discussed by keynote speaker Professor Koichi Asatani from Kogakuin & Waseda Universities in Japan.

21st December 2009 - Cooperation at the (Wireless) Network Level (time and room tbc)

Professor Anthony Ephremides from the University of Marlyand (USA) will look at novel ideas and methods that are the beginning of "cooperation at the network level", and the possibilities and implications such cooperation may have on achievable transmission rates.

For further information on the events above, please contact Professor Harsha Sirisena by email: h.sirisena@elec.canterbury.ac.nz

If you would like us to consider the inclusion of future events in this newsletter, please email Jeremy Reece the title, date, location and summary of your event.

WRC Helping Your Company

WRC has been in operation for over a year now and much of the research we have conducted is already being included in new, innovative products.

Through connecting advanced applied research with the needs of wireless companies we are achieving our goal of creating new opportunities for New Zealand.

Our door is always open and we are keen to broaden our reach to support other industries in the wireless space.

We look forward to hearing from you

NZi3 Wireless Research Centre team

Contact us:

www.nzi3.com/wrc

Jim Cavers
NZi3 Wireless Research Centre,
Acting Director
T: +64 (0)3 364 3838
E: jim.cavers@nzi3.com

Jeremy Reece
NZi3 Wireless Research Centre,
Manager
T: +64 (0)3 366 7001 xt 7871
E: jeremy.reece@nzi3.com

ICT NZ i3 innovation institute

Wireless Research Centre
September 09 Issue 1

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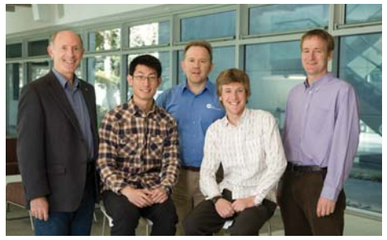
Meet the team

Currently WRC have four postgraduate students, one undergraduate student and a visiting industrialist working on various industry focussed projects.

The team possesses a wide range of expertise and experience in the wireless sector, from Jim Cavers who is a retired Professor from Canada, through to postgraduates and undergraduates enrolled at the University of Canterbury's College of Engineering. This together with visiting industry experts such as Principal Engineer (Tait Radio Communications) Clive Horn and Jeremy Reece (also on secondment from Tait Radio Communications) provide the whole team with the support they need to identify innovative solutions to industry related problems.



Above: WRC team - Jim Cavers (Acting Director), Qing Ou (Post-graduate Student), Clive Horn (visiting Industrialist - Tait Radio Communications), Dave Manning (Post-graduate Student), Jeremy Reece (Manager)

Welcome to the first edition of WRC's newsletter

NZi3's Wireless Research Centre (WRC) has just reached its 18-month milestone. The number of industry participants is growing, ideas are flowing and we're already seeing the innovations being turned into products. There's a sense of excitement here and a realisation that we really are boosting the fortunes of New Zealand's wireless community.

We are now located in the new NZi3 building, a pleasantly light and airy space that attracts research engineers from industry, academia from across the world, post-graduate students and international visitors. Amid all the thinking and talking, sparks occur – some genuinely new ideas and insights, and also the unexpected ones which lead to new market opportunities and accelerated economic growth. It's all very exciting in a new centre such as ours.

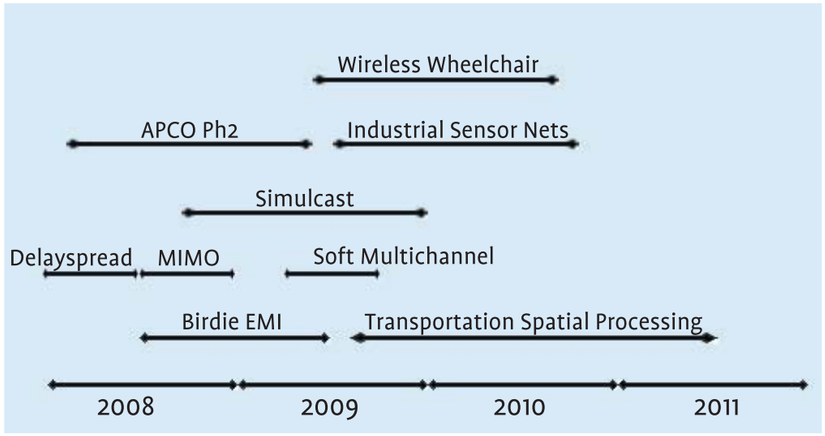
But does all the thinking and talking lead to products? You bet – just turn the pages for some innovations already delivered to New Zealand industry.

And it's also great to be appreciated. In the words of Michael Chick, former Managing Director of Tait Radio Communications (our founding partner), "The work of the NZi3 Wireless Research Centre is, in my mind, absolutely critical to the future performance of Tait Radio Communications and WRC have made a great start."

Jim Cavers
Acting Director, NZi3 Wireless Research Centre

WRC Projects Become Products

Our primary aim is to have research go into products, as illustrated in the time line below. We have already achieved some successes here and will continue to see our research going into products in the future. We try to maintain a balance of working on research that can be embedded in products in the short term e.g. 6 months, whilst innovating to enhance products over the longer term.



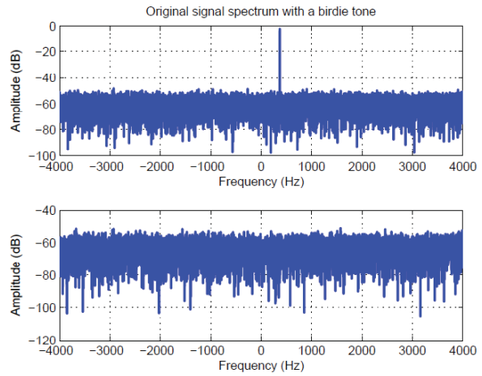
Experienced in working within the constraints of commercial sensitivities, we at WRC are very keen to meet up with members of the wireless community in order to identify opportunities for collaborative research which can bring together academia, industry, the wider wireless community and funding streams.

Jeremy Reece
Manager, NZi3 Wireless Research Centre

Winning with WRC

Tait Radio Communications, a founding sponsor of NZi3 and WRC, is already reaping the rewards of working with the staff and students based in WRC. IP from several successful projects are now likely to be incorporated into current or future products:

- **The "birdie" killer** - a method to prevent tonal interference in radio receivers: no more "deaf channels."
- **Enhanced simulcast processor** - doesn't just tolerate the echoes and fading of wireless channels, it uses them – eats delay spread for breakfast and Doppler for lunch.
- **Improved data decision method** - extracts diversity from fading – punches 10dB deeper into the noise in mobility conditions.
- **Wideband receiver technique** - use of greater bandwidth to increase both throughput and diversity jointly – pushes 15dB deeper into noise with no loss of throughput – how is this possible?



And still in the works for Tait Radio Communications:

MIMO relays, RF amplifiers, frequency sharing for capacity increase, as well as more advanced techniques which are currently being explored.

WRC Affiliate Companies

WRC would like to extend a warm welcome to the three innovative companies who they have just added to their list of affiliate companies, joining Mimomax Wireless Ltd and Tait Radio Communications...

Commtest Instruments Ltd

Global leaders in vibration analysis technology.
www.commtest.com

Dynamic Controls

Recognised as the world's leading manufacturer of electronic control systems for power wheelchairs and scooters.
www.dynamiccontrols.com

Tracient Technologies Ltd

A young kiwi company at the forefront of wireless mobile RFID software and hardware development.
www.tracient.com

A leader in vibration monitoring and analysis. Where's the wireless? It's in the research towards a wireless sensor network for collecting vibration data. The research focuses on topology that is able to dynamically reconfigure: links change, nodes change and the network responds.

It's a challenge that caught the attention of post-graduate student Geoff Clark and his supervisors, University of Canterbury's Computer Science Professor Krys Pawlikowski and Dr Allan McInnes from Electrical & Computer Engineering.

Geoff is funded by TIF scholarships from FRST, and spends half of his time based at Commtest, working with Chief Product Architect Nigel Leigh (his industry supervisor).

A member of the Invacare Group, Dynamic Controls is recognised as the world's leading manufacturer of electronic controls for power wheelchairs and scooters.

The incorporation of wireless technology into the control electronics will be a great new feature of this medical product. This presents its own unique challenges however, such as ensuring the accurate and robust communication of devices in the system.

Associate Professor XiaoQi Chen, Director of Mechatronics at the University of Canterbury, and his student, Yiwei Hu, are developing these techniques. Yiwei is also funded by a TIF scholarship, and spends half his time at Dynamic Controls, working directly with Ian Palmer, Technology Manager (his industry supervisor).

Tracient Technologies make RFID readers that can pair with any existing Bluetooth device.

To explore a new technical opportunity, they formed a three-way collaboration with an Internship student from France and Senior Lecturer Kim Eccleston, from Electrical and Computer Engineering at the University of Canterbury. The student, Pauline Henriquet, will work under the direction of Tracient's R&D Manager Paul Reid.

Wireless Energy Harvesting

Qing Ou feels that he is getting the "best of both worlds" researching at NZi3 and working for Christchurch based Commtest Instruments Ltd. Having completed his degree in Mechatronics at the University of Canterbury he is now enrolled at the University studying for his doctorate. He also receives a FRST TIF Scholarship working with industry.

The FRST TIF funding encourages innovative companies like Commtest Instruments to identify a technological problem that can be researched by a high calibre student in order to provide the company a solution to their problem, whilst also allowing the student to gain a postgraduate degree. Course selection is based on the type and level of research required to deliver a solution to the industrial partner.

Commtest Instruments specialise in the manufacture of vibration analysis equipment which monitors the health of plant machinery. Their products are used in a wide range of industries including manufacturing, pulp and paper, refinery and petro chemical, waste water and wind energy applications.

Qing's project is to find a wireless sensor solution for energy harvesting while having a special focus on vibrational energy. Globally most wireless sensors are powered by batteries. The dependence on batteries not only requires frequent maintenance to replace them, but also has inherent environmental consequences. This combination limits the realistic application of wireless sensors to smaller scale industrial settings, due to the resulting accessibility and maintenance requirements.

The ultimate goal is to address these problems using a device that is able to scavenge all of the energy it needs from the environment, such as light, heat and vibration. In recent years the power consumption of electronics has been greatly reduced, making the option of harvesting energy from the environment more viable and consequently more promising for wireless applications.

From Commtest's perspective, products that do not require any battery maintenance and autonomously transmit information will allow them to expand the use of their vibration monitoring products to other sectors including the construction and roading industries.

Currently UK and US companies are also working on a solution for this problem, making the time frame critical if Commtest Instruments are to secure the first to market advantages.

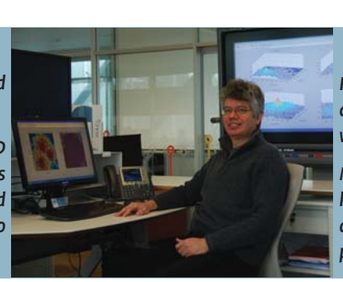
Qing is passionate about his research and is excited by the prospect of seeing the technology he's working with being commercialised.

Qing spends three days a week based in industry and two days at the NZi3 Wireless Research Centre. Commtest's staff and the business environment give Qing access to engineering knowledge and assistance relating to commercialisation. Whilst working at NZi3 Qing benefits from the resources available at the University campus including access to licensed software, workshops and instruments along with academic assistance and feedback. Qing enjoys NZi3's collaborative environment and enjoys meeting colleagues from different sectors and interacting with other companies in the ICT field.

Introducing Peter Green

Dr Peter Green is one of WRC's group of accomplished and talented researchers.

After completing his University of Canterbury PhD in 2002 , Peter became well known in industry for his advanced designs which integrated RF with DSP and FPGA processing. He also passed on his knowledge to other students by teaching at the University.



Peter worked with Smart Technologies in Canada shortly after completing his PhD, but returned to NZ in 2008 and where he acted as a consultant for Airways NZ.

More recently, Peter has been affiliated with WRC, where he has been exploring the interplay between signal detection and radio coverage on an industry focussed project.

Partnering for Success

NZi3 Wireless Research Centre's partnership with Christchurch based company Tait Radio Communications is growing with Clive Horn, one of their Principal Engineers, and Jim Cavers from WRC researching frontier technology for a digital version of simulcast. In brief, simulcast is a specialised technology for very long range radio coverage. This project, if successful, may be used in Tait Radio Communication's new Digital Mobile Radio systems.

This relationship encapsulates why WRC was set up: to support industry focussed research. Sir Angus Tait's vision coupled with financial support from the foundation he set up has enabled WRC to bring industry and academia together. This is an innovative model encouraging accomplished industry experts to collaborate with world leading academics to develop world beating technology.

However, research comes with risks. "We suspected there was a solution and partnering with a world expert was the way to prove it" explained Clive " working with someone as notable as Jim is a once-in-a-life-time opportunity that could not be missed".

"we suspected there was a solution and partnering with a world expert was the way to prove it"

Tait Radio Communications specialise in delivering systems for the public safety, utilities and transport markets worldwide. The new technology Clive and Jim are developing is predominantly targeted at the public safety and utility sectors.

Clive currently divides his week, spending two days at the company's head office working on development projects and three days in the NZi3 building working at WRC. This agreement is in place until the end of 2009.

Clive also chairs Tait Radio Communication's Research Planning Group. The group evaluate research proposals based on customer benefits, potential return on investment and strategic value.

The unique advantage of Clive and Jim's research compared with other university/academic research is that it is wholly based on industry requirements, utilising the specialist knowledge of academia with the results going ***directly*** back into systems and products that benefit industry's customers.

A core focus of the Wireless Research Centre's work is the development of technology for industrial commercialisation.