FROM ROBO-CROP TO AVATARS

YOUNG LEADERS

PHILANTHROPY ANIMATES MECHATRONICS LAB
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Leadership is a quality that we aim to develop in our students, academics and staff. But what exactly do we mean by the often-used term - "leadership"? Throughout the pages of this issue of IGNITE you will find examples of our approach to the concept of leadership.

08 WHERE ARE THEY NOW?
ANDREW TANNER  
BACHELOR OF COMMERCE (BUSINESS), BACHELOR OF ENGINEERING (MECHANICAL) (HONOURS), 2004  
GLOBAL EXECUTIVE MBA, 2014
having already received both the University’s Young Alumni award and the Bulletin magazine’s Young Achiever award in the Environment category in 2008, as well as a place on the magazine’s Smart 100 list.
Having recently shifted his focus from renewable energy generation to storage, Andrew is excited about the role of this nascent industry.
“When I first was getting into scale energy in the early 2000s, the majority of people were sceptical about renewable energy and its feasibility to compete against fossil fuels. Energy storage is now in the same infatuation state, and I believe it’s going to be an even bigger disrupter to the energy industry than renewable energy has been. The combination of the two is going to accelerate the demise of fossil fuel generators even further – and that is a game changer!”

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Cover: The Ladybird in the field on a Cowra beetroot farm.
A world-first collaboration between Australia’s first university and its first independent school is set to change the way science, technology, engineering and mathematics are taught in high schools.

‘The Future Project’ will see engineering researchers from the University work with high-school students at The King’s School’s new purpose-built science centre, to motivate and engage the next generation of scientists and engineers.

Dr John Kavanagh, from the School of Chemical and Biomolecular Engineering, will work hands-on with students on projects that could assist in the prevention and treatment of diseases such as cancer, osteoporosis and cardiovascular disease. They include extracting antioxidants from oranges for their anti-cancer properties, and producing vitamin K2 to prevent osteoporosis and heart disease. These projects bring lab work to life and engage students in the possibilities of science and engineering related careers.

Faculty Dean Professor Archie Johnston describes the project as visionary. “The Future Project has all the hallmarks of changing the way high schools could work with tertiary institutions to improve Australia’s world rankings in science, technology, engineering and mathematics (STEM) areas,” he says.

“This initiative, along with the University’s recently established STEM Teacher Enrichment Academy, will bring cutting-edge STEM thinking and practice to classrooms nationwide and inspire leadership thinking.”

The program will also be accessible to students at other high schools in Sydney’s west, and has the potential to be implemented more widely.

For more information on how you can support STEM initiatives at the University contact kristy.white@sydney.edu.au

STEM SUBJECTS TO BLOSSOM UNDER THE FUTURE PROJECT

PHILANTHROPY ANIMATES MECHATRONICS LAB

A philanthropic gift from one of our engineering alumni has led to the establishment of a state-of-the-art robotics laboratory.

The recently opened Raymond Kirby Robotics Teaching Laboratory was made possible by a donation from the James N Kirby Foundation. Son of Sir James and retired chair of the foundation, Raymond Kirby AO graduated from the University in 1951 with a double degree of Bachelor of Engineering (Mechanical and Electrical) - the precursor to today’s mechatronic engineering degree. Like his internationally renowned industrialist father, Mr Kirby has had a lifelong desire to support young Australians to “reach top international standards”, particularly in technical fields.

The new laboratory is equipped with the latest robotic and microcontroller-based hardware and software, allowing students to apply these revolutionary technologies in a realistic, purpose-built environment. Its centrepiece is a 180 cm tall humanoid robot called Baxter, which will assist students learning to program robots for industrial and other tasks.

“Mechatronic engineering provides the foundation for the ‘intelligent’ products and devices that are ubiquitous in society today,” explains Associate Professor David Rye, coordinator of the mechatronics degree.

This outstanding new facility will certainly advance Sir James and Raymond’s goal of supporting young Australians to lead the world in this important field of innovation.

NEW WARREN CENTRE EXECUTIVE DIRECTOR

Ashley Brimann has joined The Warren Centre for Advanced Engineering as their new Executive Director.

The Warren Centre is an independent, industry-linked institute committed to fostering excellence and innovation in high level engineering throughout Australia that operates within the Faculty of Engineering and Information Technologies. Ashley has over 25 years of industry experience in engineering, innovation and intellectual property management, including leading international projects in USA, Europe and Asia for Dow Corning.
**FEATURE**

**Right: Daniel Wilson**

**YOUNG LEADERS**

The faculty’s passionate, leadership-focused teaching staff are inspiring our young students to emerge as leaders in their own right rather than to merely follow.

“...in any group, every once in a while someone stands out as being head and shoulders above the rest. But in our faculty this seems to be the norm. Our students and graduates routinely disregard conventional standards of success to forge their way to the top of their fields,” says the faculty’s Associate Dean (Education), Professor David Lowe.

Clint Howard is an undergraduate chemical engineering student who recently completed a six-month industry placement in Saudi Arabia. Clint was invited by Dow Chemical to work at the site, on completion next year will be the largest of its kind in the world. “Completing my industry placement in Saudi Arabia added another dimension to my overall university experience,” he says. “The awareness of what working as a chemical engineer encompasses is now clear, and is truly a thing to look forward to.”

PhD candidate Daniel Wilson is another member of this breed. Not content to build on his BE Mechatronics (Space) by quietly completing a PhD with the Australian Centre for Field Robotics’ aerospace group, he set out his research project in the global Multi-UAV Simulink Student Design Challenge and won first prize. Skymaster is an autopilot system for pilotless aircraft that can “think for itself” and carry out specified missions with complete autonomy,” he explains.

Post-doctoral biomedical research fellow in the School of IT Ashnil Kumar has also won first place on the global stage, in the annual Cross Language Evaluation Forum Initiative’s medical imaging challenge taking top honours. The team’s artificial-intelligence inspired entry assists radiologists to work more efficiently by automatically analysing 3D scanned images of the liver and producing a detailed report, improving diagnostic accuracy. “Subtle differences in medical images are often critical in determining patient outcomes,” Ashnil explains.

The leadership achievements of sisters Sasha and Jenna Bermeister have already far surpassed those of an average lifetime – even taking into account the fact that there are two of them!

Sasha, already working as a software engineer at Google despite only just having finished her Bachelor of IT (Honours) in Computer Science, is one of online venture builder Pollenizers’ top 50 female programmers in Australia. Throughout her degree she amassed an impressive array of scholarships, prizes and places on the dean’s list and the honour roll, as well as winning the Premier’s Award. Voted 2013’s Best Tutor of the Year by the IT Society for her work with other computer science students, she is also lead coordinator of the Girls’ Programming Network (GPN). “I hope that by running the GPN, more girls are able to gain the support they need to achieve their dreams,” she says.

Jenna has almost completed her Bachelor of Computer Science and Technology, during which she has worked on a number of group projects with real clients. She currently leads a team of five, collaborating with San Francisco-based augmented-reality start-up Meta. Also the University’s Google Student Ambassador and president of the IT Society, last year she captained a team of 12 who tied for first prize in the inaugural Telstra iM2M University Challenge. Their entry was an auto-logbook for learner drivers called InGear, which plugs into a car’s cigarette lighter and automatically records the driving hours, traffic and weather conditions and road terrain details required by the transport licensing authority. Jenna sums up what it is about the University that inspires so many of our alumni to lead rather than merely follow. “The lecturers here are the best I’ve ever come across,” she says. “They are so passionate about what they do, and it’s incredible to hear about all their experiences – you can really feel the enthusiasm. I think it really inspires people to go beyond their degrees and become leaders themselves.”

Having such a gifted group of students brings a unique opportunity for us to capitalise on, says David Lowe. “With this plethora of talent in the faculty, we need to ensure that our students are challenged to reach their maximum potential. Many of our initiatives are designed to do just that, including our Leadership Scholarships and new student-driven Leadership Academy. These programs supplement students’ strong technical skills, focusing on developing their ability to use those skills to lead positive social change.”

**HUMANITARIAN PROJECT BURNS BRIGHTLY**

A team of our Advanced Engineering students has demonstrated how innovative thinking can enhance social innovation in developing communities, by devising a simple solution to a complex problem in rural Nepal.

The team of five has designed a low-cost device made from local materials that compresses waste rice husks into compact fuel briquettes for cooking. This deceptively simple innovation aims to address three issues facing struggling communities in the region: poor health, financial hardship and lack of education.

Team member Kieran Dale explains: “In the Sandikthok area of Nepal, food access and preparation is the main activity of the village. It is centred on the male of the house working in the rice paddies fields, and the women and children collecting the necessary elements for preparing and cooking the food, such as firewood. So much time is spent gathering firewood – up to five hours a day – can be used to improve their quality of life, educate the children and provide an independent income. Excess briquettes can be sold at the local market, improving the economic position of the villagers.”

The team’s successful solution to the crisis of fuel poverty was the result of brainstorming, research, development and testing. Their design produced briquettes that outperformed those of the local market on tests for quality and energy density. “The wood is also burned inside homes with little or no ventilation. The harmful gases, ash, particulates and sulphur compounds are trapped within the home, causing serious health problems such as pneumonia, acute bronchiolitis and even low birth weight.”

In response, the students designed a Charcoal Briquette Machine, which compresses plentiful rice husks into small, easy-to-store, smoke-free briquettes. A team of our Advanced Engineering students has demonstrated how innovative thinking can enhance social innovation in developing communities, by devising a simple solution to a complex problem in rural Nepal.

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FROM ROBO-CROP TO AVATARS: UNEXPECTED COLLABORATIONS

The world-leading multidisciplinary research and teaching centre takes both its name and its philosophy from Dr Charles Perkins AO, the first Aboriginal man in Australia to graduate from university. He was also a pioneer of social change who dedicated his life to resolving some of society’s most significant problems through partnership and collaboration.

Established to ease the global burden of complex health conditions including obesity, diabetes and cardiovascular disease, the Charles Perkins Centre brings together researchers, clinicians and students from all of the University’s faculties and beyond to demonstrate how collaboration across traditional boundaries can result in real-world solutions to multifaceted problems.

Two of the centre’s projects show just how effective this approach can be.

In the first, internationally renowned field robotics expert Professor Salah Sukkarieh is collaborating with researchers from agriculture, business, science and veterinary science to develop new ideas and technologies that will improve our complex food production systems. The team is examining beef and dairy cattle, apples, almonds and wheat to work out how we can get the best out of harvesting, production, distribution and logistics systems while optimising nutritional quality.

Partnering with farmers across Australia, Professor Sukkarieh is also testing robots that fly over crops and orchards to precision-spray weeds and keep herbicide use to a minimum. This ensures the soil and wider ecosystem are protected, ultimately providing us with healthier food.

And his work is already being recognised. Professor Sukkarieh recently earned the title of Researcher of the Year from Australian vegetable industry peak body Ausveg, for his work on intelligent farm robots, in particular the Ladybird.

Ladybird was designed and built specifically for the vegetable industry with the aim of creating a ground robot with supporting intelligent software and the capability to conduct autonomous farm surveillances, mapping, classification, and detection for a variety of different vegetables. The solar-powered intelligent robot recently demonstrated its abilities by driving autonomously through some of Cowra’s onion, beetroot and spinach farms, gathering information about soil and crop health, and detecting plant and animal pests. It also has the future potential for autonomous harvesting. “Ladybird is a completely new approach to agricultural robotics”, Professor Sukkarieh says.

The second project brings together Professor Rafael Calvo, a software engineer specialising in human-computer interaction, and endocrinologist Professor Stephen Twigg. Together they’ve created an avatar-based app, the Intelligent Diabetes Lifestyle Coach, which will help people with diabetes stick to their treatment programs.

Still a work in progress, the app interface has a human-like ‘personality’ which records and offers feedback on the user’s consistency in following their diabetes treatment, as well as providing goals and plans. It works towards ‘self-efficacy’ – where users no longer need it to coach them with their ongoing diabetes treatment. The app harnesses the kind of user engagement and immediacy normally found in games, but with a medical level of rigour.

With diabetes steadily on the rise both in Australia and worldwide, the potential of the app is obvious.

Vice-Chancellor Dr Michael Spence describes the Charles Perkins Centre’s collaborative approach to addressing the world’s most pressing problems as a world first: “The Charles Perkins Centre represents a completely new way of conducting research. The breadth and depth of research conducted by the centre is unparalleled both in Australia and internationally.”

MORE INFORMATION

About the Charles Perkins Centre
sydney.edu.au/cpc

The Charles Perkins Centre would not exist without the generous support of donors who believe in its work and want to help make a difference to future generations.

sydney.edu.au/perkins/support
COLLABORATING WITH CHINA

NEW BIOMEDICAL ENGINEERING ALLIANCE

The University has formed a $2 million international partnership with Shanghai Jiao Tong University that is expected to deliver significant biomedical engineering outcomes to both countries. The agreement will see the two world-class institutions consolidate their existing relationship to lead advances in biomedical engineering through joint research, information exchange and academic mobility. Each has agreed to invest $1 million in the alliance.

Faculty Dean Professor Archie Johnston explains the significance of the alliance. “Building on our institutions’ existing strengths in biomedical engineering and medicine – in particular, biomedical research, information exchange and leadership ability – this alliance will bring together world-class researchers to collaborate on transformational projects.”

Collaborators from the University include our own faculty as well as Sydney Medical School and the recently established Charles Perkins Centre, which focuses on research into obesity, diabetes and cardiovascular disease. Collaborators from Shanghai Jiao Tong University (SJTU) include the School of Biomedical Engineering, the School of Medicine and the Translational Medicine Research Centre.

The agreement was signed by Vice-Chancellor Dr Michael Spence and Party Secretary and Chair of the University Council at SJTU Professor Jiang Sixian, on his first visit to Sydney!

S
ophia Wang developed algorithms that can aid the scanning and reconstruction of target medical images, such as MRI, by removing the artifact and noise from the images. The human central nervous system has a visual system that gives organisms the ability to detect and interpret information from visible light to build a representation of the world. Sophia says the experience inspired her to greater heights and future research collaborations between her two alumni universities.

Interpreting how a human’s visual system works was the thesis focus of Shanshan (Sophia) Wang, the first University of Sydney Postgraduate student who accepted her PhD recently in Shanghai.

CHINA’S HIGHEST AWARD GOES TO WIRELESS EXPERT

Wireless communication expert Professor Branka Vucetic has been awarded one of China’s top honours - the Chinese Government Friendship Award.

P

rofessor Vucetic was presented with her citation at a ceremony held in the Great Hall of the People, Tiananmen Squares, Beijing in October.

The People’s Republic of China’s Vice-Premier Ma Kai, presented Professor Vucetic with her award saying “the Certificate of Friendship is awarded to Ms Branka Vucetic in appreciation of her enthusiastic support for China’s construction and her friendly co-operation”. The Chinese Government Friendship Award is given by the central government for continuous and sustained cooperation in education, science, technology, management, sports and culture.

In Professor Vucetic’s case it was given for her long-term cooperation with Chinese tertiary institutions and her contribution to furthering education, science and technology in China.

A TRULY INTERNATIONAL PHD

Sophia completed her PhD under the mentorship of Professor Dagan (David) Yang, a world leading biomedical imaging expert. Sophia says the experience inspired her to greater heights and future research collaborations between her two alumni universities.

“I have had the benefit of being involved in world-class research conducted at both universities. The wonderful experience at Shanghai Jiao Tong University is indispensible to forming my career development plans. My time at the University of Sydney has enhanced my social commitment and responsibility, critical and creative thinking, innovation, and leadership ability.

Sophia has secured a role at the Chinese Academy of Sciences, the most prestigious research organisation in China.

DOLPH AND ROLF TOGETHER AGAIN

Actor Dolph Lundgren recently visited the University to relive his days as a chemical engineering student.

Dolph participated in an international exchange program to Sydney in 1982 as part of his postgraduate chemical engineering studies with the Royal Institute of Technology Stockholm.

Reminiscing with his former thesis supervisor, Emeritus Professor Rolf Prince, Dolph toured the chemical and biomolecular engineering laboratories and heard about the latest research being undertaken in the school.

Dolph admitted his Hollywood lifestyle is very different to that when he was a student “I was always studying or training. I had practically no social life, although I did enjoy my time working out with some of the guys who later went on to play with the Waratahs.”

During his visit, Dolph also lent his support to the University’s Pave the Way campaign, the first ever 24-hour fundraising challenge by an Australian university which raised close to $2 million for two important causes; access to education and medical research.
KEEPING THE CLOUD CLEAN

The rise of cloud computing has brought with it the threat of large-scale electronic waste. One of our IT experts is pushing for global guidelines to tackle the industry’s potentially huge carbon footprint.

Professor Albert Zomaya, the University’s Chair of High-Performance Computing and Networking, says there is an urgent need for guidelines to ensure the reduction and recycling of all this e-waste.

“When our data ‘in the cloud’ rather than on individual devices is becoming the convenient norm, half of us give thought to the fact that this trend relies on massive, equipment-filled data centres around the world, whose contents will one day end up as landfill.”

Professor Albert Zomaya

“Data centres can be as large as a football field,” Professor Zomaya explains. “Much of what is currently being used in data centres serves a purpose, for example, will [eventually] simply be stripped of its precious metals and then used as landfill in developing nations.”

With several large data centres in Australia alone, and China currently building one that will be almost as large as the Pentagon, now is the time to address the future environmental impacts of cloud computing and ensure that this convenient growth industry will also be a sustainable one.

“The industry is like a rapidly growing tree,” Professor Zomaya says. “We are now in a perfect position to develop and implement international guidelines on how to find solutions to reduce and recycle massive amounts of computer waste.”

Professor Albert Zomaya

A DYNAMIC WEB CHOICE

With its vital leadership role across government, finance, defence, emergency services, telecommunications, infrastructure, energy and mining, project management is fast emerging as the career of the future.

Staff and students at the University are in no doubt about the critical importance of the project management profession in today’s world.

“Recent research indicates that project management is the skill most in demand by organisations today,” says Bachelor of Project Management director Dr Kenneth Chang.

Dana King is in her third year of the combined Bachelor of Project Management and Bachelor of Engineering. While she loves the technical and innovative aspects of engineering, she sees the leadership and multidisciplinary nature of project management as a means of becoming involved across all aspects of a project – and making her future career more satisfying.

“With project management I will have the opportunity to lead the project, see all the pieces come together and really experience the thrill of completing large-scale projects,” she says. “It will create so many more career opportunities, more variety and I get to work with such a diverse group of people.”

Almost 75% of our sample group time dancing, shuffling and gesturing ... In a very public space, some people spent time dancing, shuffling and gesturing ... The findings were quite unexpected.

“Almost 75 percent of our sample group were surprisingly playful. ... Some people spent almost their whole time dancing, shuffling and gesturing. ... The findings were quite unexpected.”

Professor Kay

COMPUTERS TAP INTO OUR INNER CHILD

No longer confined to the desktop, computing interfaces are becoming increasingly novel and interactive – and are inspiring some surprisingly playful behaviour.

Professor of Computer Sciences Judy Kay leads an interdisciplinary team at the Computer Human Adapted Interaction Research Group (CHAI), developing public interactive displays (PIDs) with which users can instinctively interact without requiring complicated instructions or training. Similar to giant touchscreens but operated with natural hand gestures, PIDs are being used in urban areas for entertainment and marketing purposes as well as in libraries, museums and other public spaces to present information in visual and interactive ways.

Professor Kay is primarily interested in their educational use, but emphasises the importance of users being able to engage with them naturally and spontaneously.

A recent project by the CHAI team shows that people are doing just that. A video game called the Inner Cruiser is a software framework for interactive experiences. It demonstrates some sort of playful behaviour.

Professor Kay’s team recently presented their findings at the international Pervasive Displays Conference in Copenhagen. The team’s observations will be used to develop more user-friendly applications.

Read more about Judy Kay and her research at sydney.edu.au/engineering/it/about/people/staff/kay

LEADING THE WAY IN PROJECT LEADERSHIP

A new era in executive education for Australia commenced recently as the University of Sydney welcomed its first intake of professionals to its landmark Executive Leadership in Major Projects program.

Participants included senior executives from multinational and international (UAE, USA and China) projects across industry and government including banking and finance, infrastructure, telecommunications, oil and gas and construction industries.

Offered through the John Grill Centre for Project Leadership, the uniquely designed executive education program runs for six weeks and comprises three face-to-face two-week residential blocks plus an in-organisation project.

For more information visit: sydney.edu.au/johngrillcentre

INSPIRING THE NEXT GENERATION OF QUALIFIED MANAGERS

At a two-day Project Management Winter Camp held in the school holidays, leading industry and academic experts showed senior high-schoolers the value in project management as a life skill and systems thinking as a holistic and integrative perspective to tackle complex problems.

Watch the video and see how we are educating high school students about careers in Project Management at sydney.edu.au/engineering/videos/
Aerodynamics, unmanned aerial systems and space avionics featured in celebrating the history of the University of Sydney’s aeronautical engineering discipline, which this year marked its 75th anniversary.

REACHING FOR THE STARS

Aeronaautical engineering PhD candidate Ben Morrell has been awarded the Northrop Grumman Foundation American Australian Association (AAA) Fellowship for advanced research and study in science and technology.

Ben, co-supervised by Professor Greg Chamitoff and Associate Professor Peter Gibbens, will undertake research on the development of advanced control systems for robotic spacecraft at Texas A&M University, NASA’s Ames Research Center and the Massachusetts Institute of Technology, beginning in early 2015.

“Space is the new frontier,” says Ben, who sees the galaxy opening up more missions to Mars and more human presence in space,” says Ben.

“Space mining will eventually become a reality. This would be driven largely as Space X, Orbital Sciences and more to commercial entities such as the human presence in space,” says Ben. “Space mining will eventually become a reality. This would be driven largely by autonomous systems such as the robotic spacecraft I am investigating”.

If you would like to support our aerospace initiatives please contact kristy.white@sydney.edu.au
Sancta Sophia College is a residence for undergraduate women and postgraduate men and women. Our complete living experience means you’ll get the best out of uni life.

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