Transcript

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Presenters: Venus Liao, Dr. Tony Cricenti, Mahdi Shariatian
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Venus Liao

Hello, everyone. Good afternoon. My name is Venus Liao. Welcome to Swinburne webinar series on a Wednesday afternoon. I'm the Regional Recruitment Manager from Swinburne University. I look after the Australia Onshore and New Zealand region. I hope you are all doing well and healthy.

Thank you for joining us today for virtual training on Swinburne Robotic, Electrical, and Electronic Engineering. This is part of the Swinburne webinar series I'm running from the month of May to July.

On your right-hand side are the panelists for today's webinar, Dr. Tony Cricenti, Energy Department Chair of the Telecommunications, Electrical, Robotics, and Biomedical Engineering in the School of Software and Electrical Engineering. And Mahdi, the International Recruitment Manager from the faculty of Science, Engineering and Technology at Swinburne University.

Today we'll be hearing from Dr. Tony Cricenti, talking about study robotic, electrical, and electronic engineering at Swinburne, how this discipline has been impacted by COVID-19, and how are we, as a university, preparing our students to deal with global impact of pandemic and future scenarios. We will also be talking about projection of emerging jobs of this field.

If you have any questions during the presentation, please leave your question in the Q&A box down below. At the end of the webinar, we will leave five to 10 minutes to go through the questions together. If we can't answer your questions today, please feel free to contact Mahdi or your regional recruitment managers from Swinburne University.

Without further ado, I'd like to introduce today's presenter, Dr. Tony Cricenti, Department Chair of Telecommunications, Electrical, Robotics, and Biomedical Engineering in School of Software and Electrical Engineering from Swinburne University. Thank you, Tony.

Tony Cricenti

Thank you, Venus, and welcome everybody. I'm working from home because of the COVID situation, so please bear with me because my network isn't as fast as I would like it to be.

But what I'd like to talk today, about, is what we're doing in terms of engineering. What if I say engineering of the 21st century? So this is, how is engineering going to impact the way we live and work in this new century. And also touch on some of the challenges that we're facing because of the

COVID-19 situation. And I'm sure you're all experiencing some of those issues as well. So I'll talk a little bit about those in the context of what we're doing going forward.

Next slide, please, Mahdi. Thank you. So what are some of the challenges that we're facing in the 21st century, and how are we going to tackle these problems and issues, is really what we're speaking about.

So some of the big challenges for us in terms of engineering are, for example, renewable energy and the upcoming Industry 4.0, Smart Cities, space, which is sort of fired up again, health, and let's also talk about COVID-19. All right. So the whole point is that we need engineers, and engineers make a world of difference. And without engineers, our society, and the way we live, and work, would be very, very different from what it is today. Mahdi, next slide, please.

OK. So one of the major challenges that we're faced with is moving away from fossil fuels to renewables. And why is this a challenge, and why is this Important Well we've all heard of climate change and global warming. You know, the science says that it's our reliance on fossil fuels that is making the Earth's climate change, and change, not in a good way, right? So this will impact all of us. And we need to do as much as we can to try to arrest this change, or at least slow down the change.

So one way we can do this is to start using more renewable sources of energy. So in Australia, we're shifting to renewable energy. We've got lots and lots of solar farms, and photovoltaic panels on houses, on rooftops, and we boast about having 1 and 1/2 million solar photovoltaic systems across the country. When you think about, in terms of our population, that's quite a few solar panels per person around Australia-- or at least per home around Australia.

Now this sounds quite simple. Let's put some solar panels, let's put some windmills up, and we can turn off our coal fired power stations. Unfortunately, it's not quite that simple. Having all these renewable sources where the energy doesn't come uniformly, and constantly during the day, but comes in peaks, causes problems to the electricity grid.

We can get situations where the grip becomes unstable and the operators of the grid have to turn-- basically, turn the power off in parts of the grid to ensure the stability. So we need methods to integrate these new renewable technologies into the existing grid. So this problem needs to be solved by engineers rethinking the way the grid works, and designing new equipment, and new technologies to make sure that the grid remains stable, and we don't get blackouts, or what we call brownouts, due to these fluctuations in generating capacity from the renewable sources.

There are predictions in Australia that we're looking at roughly 6,000 new jobs in the next five years for electrical engineers. And in Australia, we have a situation, too, where electrical engineers are getting older. Not a lot of young, let's say, graduates, go into electrical engineering. And that's a bit of a pity because there's lots of work out there. And as I said, the engineering population is getting all gray-haired. So yeah, I think there are lots of opportunities for our students going into those fields.

Next slide, please. The next big challenge is coming about revolutionising the way our manufacturing industry works. You may have heard of Industry 4.0. Essentially, it's the fourth wave, or if you want, the fourth big change in the way the manufacturing is conducted. We started off with using coal and

steam, we moved onto electricity and production lines, for example, in the second revolution. Then around about the 1970s, we introduced computers and some primitive robots into our manufacturing.

So the next step is to actually add intelligence. So sophisticated robots, what we call the internet of things, what we called cyber physical systems. And cyber physical systems are essentially systems that are run using software and computing. So this is the next big phase in manufacturing. And at Swinburne, we've got this partnership with Siemens, and we've built a facility which we call the Factory of the Future. And I think we've got about $135 million invested there in order to start prototyping some of these new industry, or these new technologies for industry.

So what do we need in this case? Well we need telecommunications engineers, electronics engineers, because they need to transform the existing manufacturing-- factories, and production lines, and things-- into these new, intelligent, autonomous systems, or manufacturing systems. So there's a big need for those sorts of engineers.

Also, in terms of the robotics, currently, most robots are big, dangerous, machines, right? They're usually in cages. We can't have people working next to them because of safety concerns. With the new technologies in robotics, we're moving more to what we call collaborative robots. So these robots are robots that can work with people. So they're not dangerous. They can sense a person, and if they're moving, they will stop moving, and provide a safer environment. So these collaborative robots are going to be in these new factories and they'll work side by side with humans in a safe way.

The other issue with Industry 4.0 is what we call rapid prototyping. And this takes into-- talks about things like 3D printing, those sorts of technologies. So what we can do is, we can design a part on a computer and send it off electronically, through a network, to a manufacturing facility which could be anywhere in the world, and build a prototype very quickly. So we can start shortening the length of time it takes to take a product to market.

IOT, which is internet of things, well this is basically, our manufacturing systems, now, will have lots of sensors, lots and lots of actuators. And the data that comes from these sensors will be processed, maybe, in the Cloud. Maybe there'll be some artificial Intelligence that decides what to do, and then the information or the commands are sent back to the actuators to perform the tasks.

So all this data, it's hard for humans to process this data so we'll be employing artificial intelligence a lot in this scenario to cope with the amounts of data and actually get things to become more efficient in terms of production. So combining internet of things, robots, big data, augmented, or virtual reality, is the future of manufacturing. So that's what we call, as I said, Industry 4.0, in a bit of a nutshell. Next slide, please.

Another big challenge for humankind in the 21st century is the fact that a lot of people are now moving to live in big cities. So there's this flock to the cities, or urbanisation. Now some of the challenges that have come from this are that our cities are becoming crowded. There's a lot of pressure on the infrastructure, a lot of pressure on roads-- you know, congestion. It's taking a long time, these days, to travel to and from work. We're producing a lot of carbon dioxide, which is not helping with global warming or climate change.

So all these pressures are making it harder and harder to live in the cities. But as I said, more than 50% of the world's population now lives in cities. And this is expected to grow, going forward. So how can we tackle these issues or these problems? Well, one way is to start building infrastructure that is smart. We can have, for example, buildings that can efficiently use their heating, ventilation, and air conditioning in order to minimise power usage, and therefore CO2 emissions, while still keeping people quite comfortable.

Again, another area is in transport. So what we want to do there is employ what we call intelligent transport systems. And this is where things like the traffic lights-- you know, various traffic-- how do I put it? Traffic systems are employed so as to reduce the amount of congestion.

Now, another thing that we can do in terms of intelligent transport is use autonomous vehicles, or vehicles as a service. Things like Uber. So instead of owning your car, you could ring an Uber, autonomous car, and that would come and take you to work or pick you up and take you where you need to go.

Now all this Smartness, we need a lot of communications. We need all these systems to communicate with each other. And we need a new, or a better, let's say, communications network. And the 5G network, which is a mobile network, is what's going to enable a lot of this change.

So what do we need in terms of engineering? Well, we need the engineers who understand all these new technologies, and they can build the new infrastructure, and also the communications networks, the road networks, those sorts of things that add the intelligence to the cities. And we'll also need engineers that understand how to collect data, and then how to process that data, and what you can do with that data. And maybe use artificial intelligence to process some of that data in terms of running traffic lights, or deploying the appropriate systems.

The projections in terms of job growth here, I could only find this for telecommunications engineers, unfortunately. And we're looking at, say, 3,000 jobs over the next five years in Australia, in telecommunications. So there's definitely growth there for that discipline of engineering. Next slide. OK.

Now, I was going to use a pun and say that space has taken off again, and it's actually quite exciting. You would have noticed a couple of days ago-- it was about a week ago-- we sent up two astronauts up to the space station. And they were using a private, or commercial rocket, if you want. So one of Elon Musk's SpaceX rockets.

This is really exciting, right? This is-- you know, we're going back to, I remember when I was a child, when man went to the moon. It was amazing, and I feel this sort of excitement starting to rise again. People are talking about Mars missions. We've got these reusable rockets, so space is going to become one of the hot areas in terms of technology.

So what do we need here? Well again, we need to design and develop vehicles, systems, and equipment for space travel. And at the moment, this equipment is very, very expensive. We re talking millions to billions of dollars. So there's a lot of work there that needs to be done to make this a lot less costly, let's say.

Again, when we start looking at the technologies in terms of Smart Cities, lots of IOT, Industry 4.0. We're going to need really good telecommunications networks, so this is going to mean more and more satellites being launched. At the moment, we have what are called CubeSats, and you can see an example of a CubeSat in the photo. These are small, relatively cheap satellites that we can deploy.

Again, there's an industry around designing and building these satellites, and so we'll need electrical, electronic telecommunications, software, robotics engineers, to build all these devices and equipment that we'll need for the space industry. And again, we need engineers who can collect, analyse data, as we were saying before.

Now it's hard to know what sort of numbers we'll be employing, in terms of engineers in this sector. But Australia, the projections are that we're going to triple the size of our space industry by 2030 to around $10 billion. And Australia is becoming very, very competitive in terms of the space sort of industry. So again, this is one of the things that we'll see more of in the future. Next slide.

Another big challenge is that of health. And we're seeing right now, we're in the middle of a bit of a health crisis with COVID-19, but there are other challenges. And this is something that we need to tackle, not just from the engineering side, but from other areas of society. But what are the issues? Well, one issue is that we have an aging population.

So we're getting older as a society. And as we get older, obviously, we have a few more health problems that go along with that. But not only health problems. There's also the fact that the elderly might be living on their own, which makes them lonely, and this can cause mental health issues. So there's a lot of work, or a lot of new technologies that are being deployed to assist in the aging population.

But there's also big growth in medical technology. There are a lot of new techniques, new equipment, that is going to be deployed to deal with health issues. And again, we will need appropriately trained engineers to develop these systems, and maintain, and deploy these systems.

So things around telehealth, so remote health. We're seeing a big increase in telehealth in Australia, at the moment, with COVID-19, where instead of going to see the doctor, you actually have a Zoom meeting with the doctor and discuss your health issues that way. It seems to be working OK, and I can see this happening a lot more in the future. So instead of visiting the doctor, you might just ring the doctor up and have a Zoom meeting with the doctor.

But telehealth also means that we can do things like operate, perform surgery, remotely. So if someone is in a remote area of Australia, in one of the little towns in the middle of Australia, it's very difficult to get that patient into a big city to perform the surgery. But it may be possible to have surgical robots, and through telehealth, have a surgeon operate remotely on that patient.

Now this technology's not quite there yet, but we do have robotic surgery, or surgical robots, that are deployed, currently. Although usually the doctor's sitting quite close to the robot, as you can see in the photo.

Next big thing is also 3D-printed implants. So we can custom make scaffolding for tissue, for example bones, or joints, by using 3D printing techniques. So this way, you can custom make the part, let's

say, or the bit of tissue, or bone, that has been damaged in a particular patient. You can make a custom made one that suits that particular patient. And this is, again, a technology that's happening right now.

Another one is what we call BioRobotics. And this is where, for certain disabilities that someone may have, or injuries, we can have a robot assist that person. So maybe like an exoskeleton, or some prosthetic limbs, or those sorts of things. And these technologies, again, are being looked at.

Also the use of virtual and augmented reality. Again, this will come back to telehealth. And we can manipulate, perform surgery, look at images, or take images, using this virtual or augmented reality technologies.

So we'll need biomedical, electrical, electronic engineers, again, telecommunications, robotic engineers, to build these surgical robots, to make sure the telehealth networks work efficiently, et cetera, et cetera. And again, medtech is becoming a big industry in Australia. And big companies such as Cochlear, ResMed, Fisher and Paykel, healthcare, with a lot of other, smaller industries, are actually growing very rapidly and producing medtech devices. And in my department here at Swinburne, we have a facility to encourage taking ideas in medtech to actual, real products. So it's one of the big growth areas for us too. Next slide.

Now COVID-19. COVID-19's-- again, it's been a terrible thing. It's one of these things that we never wished had happened. It's affected the whole world, so there's no boundaries to this virus. But what's come out of it? Well you know, besides the tragedy, we've noticed that we've changed the way we work. A lot of us are working from home. And again, that's made some challenges for everyone.

So we expect that we will change the way we work, going forward. We have to make sure we don't end up with this virus not being controlled, and we don't want another, new virus, to create havoc like this one did. So it will change the way we work.

It's also changed education. And Swinburne has responded to this by having to-- you know, we had to shut the campus down. It wasn't our choice, but we had to do that. And what did we do? Well, we rose to the challenge and we started delivering our course online. We didn't have a lot of time to do this, we had to do this fairly quickly. But what we did, we offered students both synchronous and asynchronous classes.

So in the synchronous ones, we actually had live Zoom or Microsoft Team Sessions, so what we used, collaborate with our students. And we try to run as close as possible to a face-to-face setting. The asynchronous ones are where we have chat sessions, and students can leave their questions, and tutors will answer those questions or help the students there. So they're the sorts of technologies that we've deployed, and we'll still use these going forward to supplement what we do.

The other thing we developed at Swinburne, which we think we're very proud of in my department, because we were the pioneers of this, is what we call remote laboratories. And here we're using our Cisco lab facility, our Cisco Academy facility, to have students actually, physically, do the laboratories that they have to do, that would have done on campus, they can now do from home.

So they can log into a Swinburne machine on campus, and perform the experiment just as they would if they were sitting in the actual lab. So we've deployed this for our Cisco, and also our Microsoft-based units.

We've also re-looked at the way we assess students. And next week, we'll start doing our final assessments. And again, this is to take into account the fact that most students are working from home.

But what's the future? As I said, I think COVID-19 means that we're going to change the way we work. You know, companies are already seeing the benefits of some staff working from home, so I expect this to continue. That, again, will provide challenges, but some of them we've already spoken about. Things like rapid prototyping, where I don't need to be in the factory to actually produce a prototype. I can actually do it on my machine at home, and send it off for it to be built somewhere else. And you know, the robots might be doing the building.

Again, we'll probably see more and more robots being deployed in areas where it might be risky, in terms of health situations. So there's some of the things that will happen in the future. But I need to probably move on to the next slide.

And so, how are we going to get these people who are going to engineer the 21st century? Well, we've got a few courses at Swinburne around engineering, and you know, I'd love to see more students do engineering. I think it's a great profession. But we offer are Master of Engineering Science, and here we have three specialisations offered by my department, which are Electrical and Electronic Network Systems, and Telecommunications. So two-- two, not three. There is another one.

Then the second course is Master of Science Network Systems, and this allows students to gain Microsoft and Cisco certifications. And it's very specialised in terms of telecommunications networks, which is around 5G and those sorts of things. The third master's is Master of Professional Engineering. And here we can do the renewable energy, robotics, mechatronics, and micro electronics areas.

We also have some majors in our Bachelor of Engineering Honours Degrees, both professional and just the straight Bachelor of Engineering. And here we can study biomedical, electrical, electronic robotics, mechatronics, software, and telecommunications. So we can address these, what we call advanced engineering areas in these courses.

But why study at Swinburne? Well one of the things Swinburne prides itself on is our connections with industry. We've been doing work integrated learning for many, many years. I've been at Swinburne for 30, and we've always had work integrated learning for our students, so that's a big plus.

Second is, we have very good teaching quality and excellent research. Electrical Engineering was rated by ERA as five, which is well above world standard. We've also got cutting edge facilities, great labs. Our Cisco lab is-- well, it's probably the best in the world. And students get access to real equipment using this Cisco facility.

But just to close off, in my opinion, Swinburne as a great little university. As I said, I've been there 30 years. I love the place, and I love all the students that come through. I think I'm going to stop there because it's probably getting on time, but any questions?

Venus Liao

Thank you, Tony, for your presentation. We've actually hitting the 2:30 mark already. So we've just got one question here, which I might ask you or Mahdi to give a short, quick answer on that. What's the difference between Engineering Science and Professional Engineering?

Tony Cricenti

Really, they're titles that we've given our courses. The Engineering Science is more, let's say, a theoretical course, where we go in-depth into the subjects that we teach, the various disciplines.

The Master of Professional Engineering has, let's say, more of a vocational approach to things, where students get exposed to what happens in industry, what happens when you actually go into work. A lot of project management, so there's a project that's based with an industry partner, we work very closely with that industry partner. And there's a lot of teaching around the career side of the profession.

So the two, one's a bit more theoretical, and the other one's probably a lot more practical, let's say,

Venus Liao

Thank you. And are these course accredited by EA?

Tony Cricenti

Yes. All our bachelor degrees are accredited by EA. Master of Engineering Science has, I think, got-- what's it called? Provisional accreditation, but that should change, I think this year, as we graduate students.

Venus Liao

OK, thank you. I will bring this webinar to the end for today. And thank you, again, Tony, for your presentation on Swinburne Robotic, Electrical, and Electronic Engineering. And thank you to all of you, our participants around the world, for tuning in today.

Today's presentation will be emailed to all participants after the webinar. Join us at our next webinar this Friday on 12th of June, at 2 PM, for Swinburne Health, presented by faculty of Health Arts and Design. I hope to see you again on next Friday, 19 of June, at 2 PM for Swinburne Marketing. The invitation for this webinar will be sent out to you all next Wednesday.

Thank you very much, and have a nice day everyone. Take care. Goodbye.

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