Africa's first IIoT lab launched at TUT Soshanguve South Campus

The Emerging Industrial Internet of Things Lab (IIoT) at the Soshanguve South Campus of the Tshwane University of Technology aims to empower the youth of South Africa to thrive in the smart connected world. *MechChem Africa* attends the launch and talks to Duan Gauché and Sizwe Mngadi of 1Worx, and TUT's systems engineering professor, Pius Owolawi.

Duan Gauché, chief executive of 1Worx.

Sizwe Mngadi, Emerging Lab champion for 1Worx.

TUT's systems engineering professor, Pius Owolawi.

Through the PTC IIoT Ambassador Programme, 1Worx, productONE and the Tshwane University of Technology are striving to make African products even greater. "Equipping the architects of our future with the necessary skills and tools needed to successfully compete in this new battlefield is paramount to the long-term sustainability of the South African economy," argues 1Worx chief executive, Duan Gauché.

The lab was launched on the morning of June 22nd, where current student projects were already on display along with interactive, live demonstrations of operational IIoT solutions from 1Worx.

1Worx was established some three years ago as a local vehicle for Thingworx, PTC's global innovation platform. "There is a lot of confusion in the market about what the IIoT is, and everyone has some sort of IIoT product or offering. Thingworx is much more than just an IIoT solution, it is an Industrial Innovation platform that provides many of the technologies that enables the 4th Industrial Revolution," says Gauché.

PTC's Thingworx has a whole host of capabilities, including the commonly understood IIoT features: device level connectivity; data collection and monitoring systems; Internet connectivity to cloud-based analysis; and reporting services. "In addition however, the Thingworx platform embeds augmented reality and machine learning. "By putting all of these technologies onto a single platform, we can offer the widest possible scope for innovation, from simple tracking and condition monitoring to full enterprise-wide production efficiency and optimisation solutions," Gauché adds.

"Industrial networks have existed for some time, but we are getting to the next level now. With affordability and reliability, along with this platform's ability to interconnect devices on any scale, the number of new application possibilities is mushrooming," he tells *MechChem Africa*.

"In addition, it is now quick, easy and inexpensive to do all of these things. The costs used to be exorbitant. Now I can walk into a plant and, within an hour or so, I can have that plant connected to the Internet or, where security is a concern, to a local server 'on the edge'. That's magic!" he exclaims.

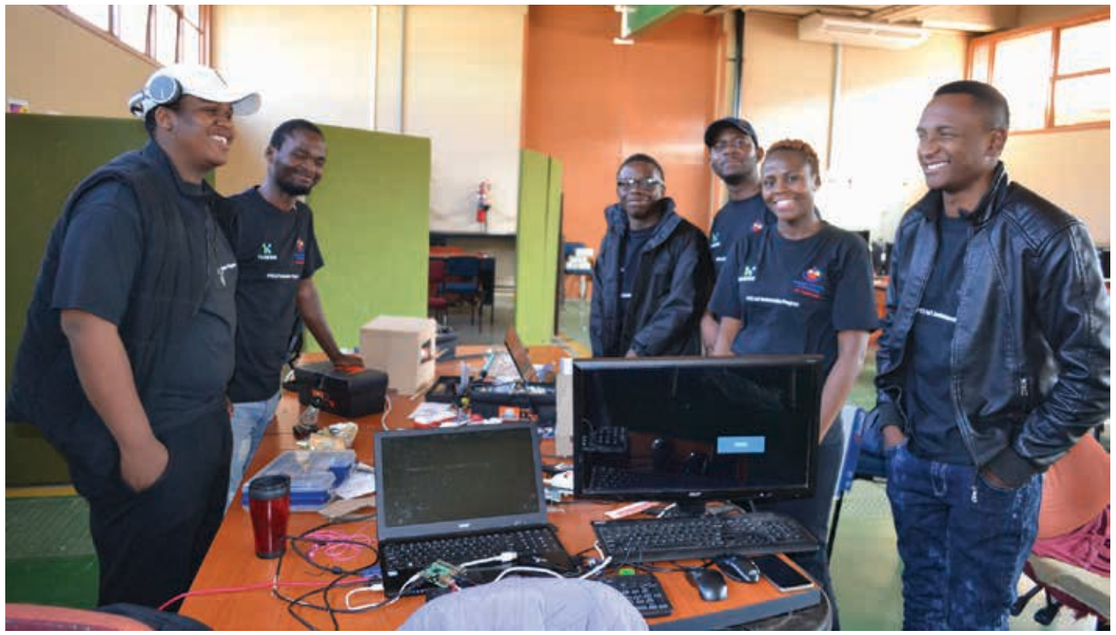
"This enables a picture of what is happening at the plant – and if interconnected, across all other plants in the enterprise – to be monitored and benchmarked.

"That is only the first step, however. Using predictive analytics, we can now start to ask the system to predict when a critical machine will break down. Taking one step further, we can instruct the system to generate an alert 30 days before any machine is predicted to fail and to also interface with maintenance services to order parts, dispatch technicians and to organise an orderly least-cost shutdown so as to restore the plant to full health," he explains.

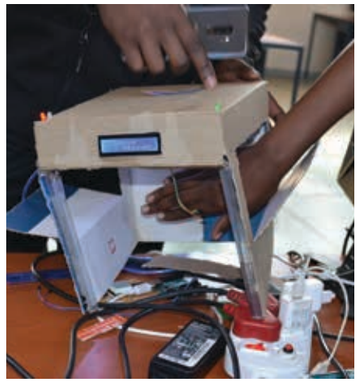
"Using diagnostic, we can also implement changes to prevent future breakdowns or to extend the life of machine components," he says, adding that these functionalities fall under machine learning and artificial intelligence components of the Thingworx platform.

Where does augmented reality fit in? Augmented reality involves overlaying information, instructions and insight onto real world products and systems. "Using a wearable headset such as Microsoft's HoloLens – or a smartphone or tablet – a maintenance technician can point towards the machine requiring maintenance and instantly download visual instructions detailing exactly how to successfully disassemble, repair and reassemble the machine," he responds.

The idea behind the Emerging Lab, according to Gauché, is to catch youngsters while at university so that they become familiar and comfortable with what this advanced platform can offer. "We are limited only by our imaginations, so by getting students thinking in this new way and providing them with some technical implementation skills, they can become our next-generation creatives, making African products and operations greater than ever," he suggests.



A team of Soshanguve engineering students in the Emerging Lab working on a mock-up loading cell ***(right)*** *for their autonomous truck loading and blending system.*



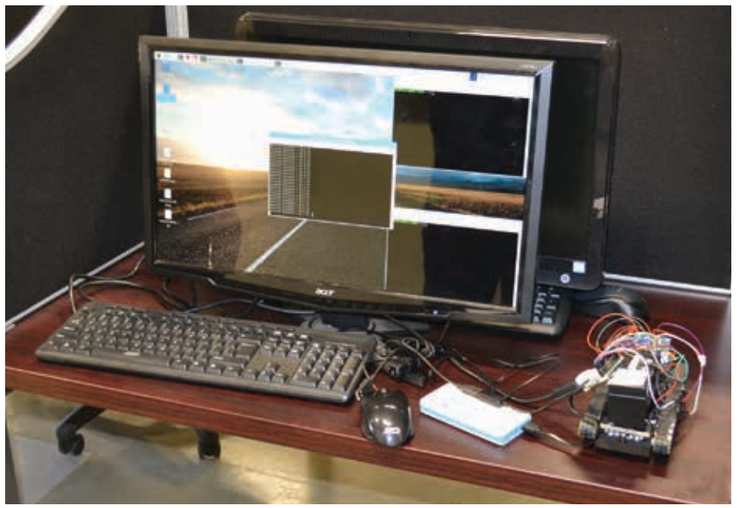
On the creation of jobs, he suggests that he can't name a single blacksmith today involved in first industrial revolution technology. "But I can name several technicians that have worked on my car. So I believe that, rather than take jobs away, this 4th industrial revolution will create jobs, but these will be very different."

PTC estimates that in the next ten years there will be two million unfilled ICT jobs globally. "We at PTC and 1Worx see the Emerging Labs initiative as an opportunity for young engineers to get a feel for what these new jobs will be like, and to build experience in this new space," he says.

"We want these students to enable our country and the African continent to leapfrog the developed world into a far more productive and prosperous future. Africa does not have the old technologies that have to be shut down for this to happen. We can now overcome a host of historical challenges: cost, connectivity, distance, language and onsite access to information, for example. This technology offers massive opportunity for growth," he tells *MechChem Africa*.

Sizwe Mngadi: the Emerging Lab champion for 1Worx

Thembisile Sizwe Mngadi was, until February of this year, a TUT systems engineering student at the Soshanguve campus under professor Owolawi. "I first encountered 1Worx at an MTN function for entrepreneurs after having completed the two-year coursework component of my three year diploma. I then had to do two six-month workplace experience modules to complete my studies and I applied to 1Worx for an internship," he tells *MechChem Africa*.



A model of the IIoT connected tracked mining vehicle to be used for the autonomous truck loading and blending system.

Mngadi went on to complete both his work-based modules with 1Worx before being permanently employed on graduating.

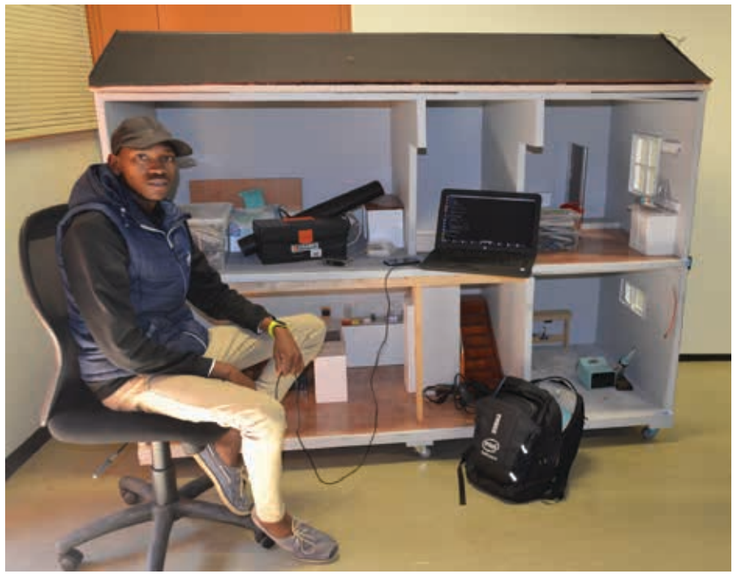
"I felt that the university coursework left a gap with respect to the practical side required in the corporate world, so I began to talk to my student colleagues and to professor Owolawi about starting a practical IIoT-based programme in Soshanguve," he reveals.

Once support from PTC's global ambassador programme was secured, along with the buy-in from 1Worx and its sister company, productONE, the establishment of the lab progressed very rapidly. Mngadi was appointed champion of the Emerging Lab at TUT, responsible for establishing and managing student projects and supporting their practical progress. "I initiate the projects and create the scenarios, based on real-world implementation. Then I support students in the use of our IIoT technology to implement successful solutions," he says.

The current example being implemented by students involves autonomous trucks that are required to accurately blend material from three different stockpiles. "The system should autonomously work out which is the most efficient route around the three stockpiles, taking into account distances, obstacles and queues," he explains.

From a sensor perspective, the weight has to be measured, along with the accurate position of trucks and stockpiles. "To achieve the position accuracy required, we couldn't use a GPS-based system. Instead we use a simple Pi camera coupled to Python-based OpenCV video analytics software – and the students have already managed to build a system to detect and avoid black-box obstacles," he reveals.

For students, this is currently an extra-curricular programme, which means that Mngadi, who remains a full time employee of 1Worx, spends weekends and time after hours supporting ongoing projects.



Setting up the IIoT infrastructure needed for the connected home.

Prof Pius Owolawi on partnerships

Owolawi believes that engineering students in Africa have been disadvantaged with respect to practical training. "I studied at MIT in the USA, where technology partnerships with industry are common and all students have access to practical equipment and labs that are funded and built by industry. I have long dreamed about replicating this model in Africa," he recalls.

"Also, the IIoT is the technology currently changing the world, so what better place to start to make the dream I had at MIT become a reality?" he asks.

"The first industrial revolution took some 100 years to arrive in Africa from Europe. The second and third were faster, but still slow. But the 4th revolution and the IIoT is coming here without any delay at all. We no longer struggle to access these technologies and that makes this Emerging Lab a very exciting development, full of opportunity," he says.

"It adds a new approach to our engineering curriculum, hence the name 'Emerging'. We are concretising engineering learning and making it more practical and more directly usable.

"We are very proud to be the pioneer of the IIoT within the Universities of Technology in South Africa. My mission is to enable our youngsters to fulfil their potential with pride and I believe that the whole of South Africa can be proud that at least one university is now producing graduates to occupy the IIoT space," he concludes. ❑

Rockwell Automation partners with PTC

Analysts such as Gartner and Forrester Wave have rated PTC's Thingworx IIoT platform as one of the strongest. It is, therefore, no surprise that Rockwell Automation has invested US$1-billion in PTC as part of a definitive strategic partnership agreement that strives to leverage both companies' resources, technologies, industry expertise and market presence. The partnership will include technical collaboration across the organisations as well as joint global go-to-market initiatives.

In particular, PTC and Rockwell Automation have agreed to combine PTC's award-winning Thingworx® IIoT, Kepware® industrial connectivity, and Vuforia® augmented reality (AR) platforms with Rockwell Automation's best-in-class FactoryTalk® MES, FactoryTalk Analytics, and Industrial Automation platforms.

"This reflects the increasing convergence between PTC's core IIoT strength and the operational technology (OT) that actually sits on the factory floor, for which Rockwell Automation is renowned," says 1Worx chief executive Duan Gauché. ❑