



Augmented reality and the IIoT

MechChem Africa visits productONE in Centurion, Pretoria and talks to applications engineer, Ross Anderson, who demonstrates how easily augmented reality (AR) experiences can be created and the advantages of PTC's ThingWorx AR platform.

While virtual reality (VR) gives developers and gamers experiences of futuristic products and 'other worlds' via headsets such as Google Cardboard, Samsung Gear VR or the Oculus Rift, AR enables users to see both the real world and the virtual world together. Virtual graphics from detailed 3D models are superimposed onto physical products to provide additional information about real object being examined. "AR can add a virtual control panel or gauges that do not physically exist, enabling real and remote intervention and real information collection," Anderson explains.

"AR enables the convergence between the physical and digital worlds, which makes all of the knowledge embedded in a digital model available to product users, via AR experiences that can be accessed using smartphones, tablets or a headset such as Microsoft's HoloLens," he tells MechChem Africa.

The idea is to create an exact virtual replica of an existing object, called a digital twin, which monitors the properties of its real counterpart – pressure, temperature, load or position – and mimics the state of the physical object. "Data can be continuously and remotely collected, so a history of each property is accumulated, allowing one to understand real world product operation in their actual conditions of use," Anderson adds.

Describing the origins of PTC's AR platforms, he says that, in 2015, PTC acquired Vuforia, the AR platform that enjoys a 75% share of the AR app downloads from App Stores. "Vuforia has continued to grow and PTC has created new products called ThingWorx Studio and ThingWorx View that leverage the technology and skills from Vuforia.

"ThingWorx Studio and View are used to create experiences and to view the experiences respectively. In addition, because these tools are connected via the online ThingWorx platform, IIoT data can be easily linked to AR experiences. This is what unlocks the real value and potential of AR. This connection to the ThingWorx platform enables content generators to provide users with relevant and live data/information about the product they are looking at," Anderson notes.

"ThingWorx View can be downloaded free by anyone with a smartphone or tablet, while Studio is for content creators, to allow them to publish Apps and experiences," he continues. "In addition, these experiences can also be created directly from PTC's Creo software suite, which is what I would like to show you now," he says.

From Creo, Anderson opens a 3D CAD model of a space shuttle. "This is a Solidworks model, but most common formats can also be accessed. I am now going to associate this model with the Thingmark that is allocated to



A 3D Solidworks model of a space shuttle published as an AR experience via Thingworks after associating the model with a licensed Thingmark.



A second demonstration involving a hydraulic pump for a BobCat-type earthmover. After scanning the Thingmark and associating it to the pump, Anderson says that, unlike a QR code or bar code, a Thingmark aligns the pump with its surroundings and uniquely identifies position and scale information.

this license of Creo," he explains. "Each user's Thingmark can be used to publish several experiences, which can each be opened via a menu that automatically pops up when the Thingmark is scanned," he adds.

He clicks on the Augmented Reality menu from the Creo workspace, scans in the Thingmark then scales it down and places the 3D shuttle model on top of the it. "We can then simply publish this experience," he says, following another click.

Moving over to an iPad, Anderson scans the same Thingmark from the ThingWorx View app. "Within minutes, this new experience is available for viewing by anyone with a smartphone, tablet or an AR Headset, from anywhere in the world," he notes, while demonstrating how the 3D CAD model can be rotated for viewing from any angle and

zoomed to examine detail.

"We have recently sold the first AR-enabled system in South Africa to Adlam Engineering for exactly this purpose. Adlam's developers are using ThingWorx to share digital information with clients and fellow developers for design review purposes. Product models under development can be annotated and shared with all stakeholders, who can then view them from all angles and interrogated the detail. This maintains total control of the IP, without having to limit communication of design progress," Anderson informs MechChem Africa.

Adlam Engineering is a world-class re-builder of mining equipment, designing and manufacturing alternative and original (OEM) replacement parts for surface and underground mining equipment. The company

strives to offer customers a positive experience and is therefore constantly updating and investing in the latest CNC machines, tooling and software technologies to ensure that the highest quality parts are developed.

"Adlam is using the functionality that comes with Creo 4.0 to very quickly generate an AR experience that can be viewed by their customers to allow them to review and understand the solution being offered. This enables Adlam's customers to understand what to expect before the product is manufactured, which makes it easier to identify necessary design changes early on in the process, avoiding costly last minute changes," Anderson explains.

"Using AR in this context is great because it is easy for everyone to understand 3D geometry in a 3D world at the correct scale. Everyone can use his or her own phone or tablet to see the 3D content, so there isn't a limit as to how the model can be viewed. With AR one can walk around the product and view it as one wants, as opposed to the traditional method of viewing 2D drawings or even a 3D model on a 2D screen, where the model needs to be rotated and zoomed by one person who has to be familiar with the software involved.

In addition, designed replacement parts can be examined in terms of how they connect into the whole machine and how they can be removed and replaced quickly and easily. "This is ideal for enterprise customers that need to interrogate exact features of a product. And, as well as for design reviews, AR is also now starting to be used to help users with maintenance," Anderson says.

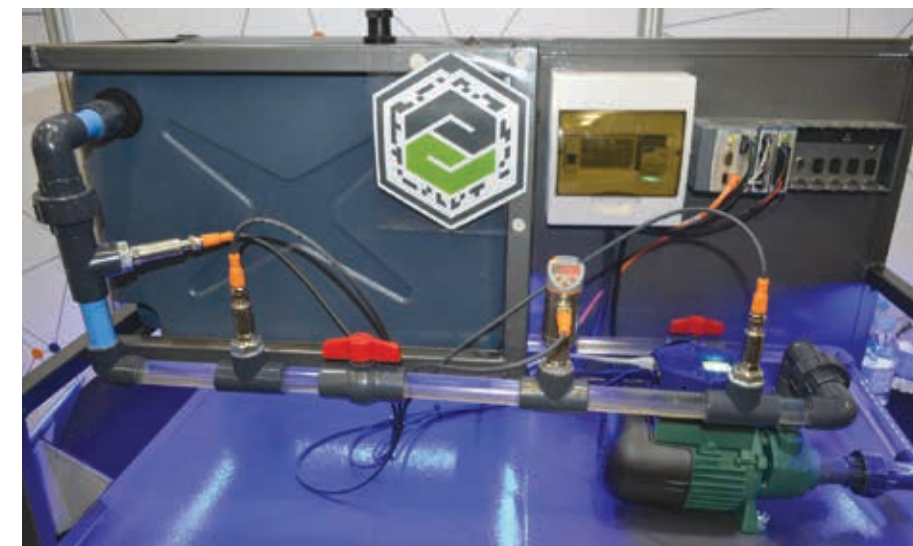
"Drag-and-drop' models have been incorporated into the AR tools menu to maximise accessibility and ease of use," he adds, while moving on to a second demonstration involving a hydraulic pump for a BobCat-type earthmover.

After scanning the Thingmark and associating it to the pump, he says that, unlike a QR code or bar code, a Thingmark aligns the pump with its surroundings and uniquely identifies position and scale information. "This allows movement around the model by changing the orientation relative to the Thingmark.

"The next thing I need is to do here is to augment only the part of interest, not its surroundings. So the unit itself will go invisible. Then I will create a part assembly experience that shows exactly how to assemble and disassemble this product.

"In addition, I can enable this experience to trigger warranties and service history information and even part ordering features – and it's all as easy as building a web page," he says.

He adds some gauges, which interact with the pump "as if it were real". "Creo AR and ThingWorx Studio have several embedded gauges for easy access, which are simple to



A pumping system and its associated AR experience being used for monitoring. As well as real time data measurements of the pump temperatures, pressures and flow rates, motor data can also be accessed along with external operating conditions such as the humidity, pressures and temperatures.



set up using property functions before connecting them to real sensor signals," he says.

"The differentiating aspect of PTC's AR platform is that we can connect the AR experience to ThingWorx, which enables specific digital and physical products, systems and components to be permanently connected, giving easy access to all of the digital information embedded in the design when dealing with real problems on actual components. This is at the heart of the IIoT," Anderson suggests.

"I have connected pressure and temperature gauges to this pump experience, but vibration for the bearings, flowrate and a host of other gauges can be added, depending on the sensors to be included in the real pump and the degree of sophistication needed," he continues.

After a quick check of the developed experience, he publishes it, rescans the Thingmark and shows the assembly animation running on his iPad.

How long did this take? Including patient explanations of each step, two new AR experiences have been created and uploaded within 20 minutes.

"This is an ideal way to give someone service instructions," Anderson says, "but we think AR has a place in just about every or-

ganisation. PTC and productONE customers are still mostly CAD users, because it is great for design reviews, but we are now seeing interest from a wider market, including the mining industry, breweries and retail businesses," he notes.

"With the emergence of digital touch-screen displays, products have already moved away from hardware controls to digital control panels that can easily be adapted to user requirements. These can also be updated quickly and deployed via downloads to existing products, so new features and functions can be made available instantly in the future, reducing product obsolescence," he predicts.

"Smart home products such as Philips' Hue Bulbs, are good examples of this being done. These not only allow homeowners to use smartphones to control their lights, they also allow for flexible automation of lighting and locking. The next step is adding AR along with voice and gesture controls so that a user just has to look or talk to the system and the controls and data needed appears.

"All this will change the way products are designed and the way we interact with these products. AR is going to have a massive effect on the way our world works and what is possible," Anderson concludes. □