

source

SEEING AND SEIZING
OPPORTUNITIES

SIOUX AND NEMO
HEALTHCARE DEVELOP
A BREAKTHROUGH IN
MEDICAL TECHNOLOGY

BIG DATA OPTIMIZATION
WILL MAKE THE
DIFFERENCE IN THE
HIGH-TECH OF THE
FUTURE

MAARTEN STEINBUCH:
'SIOUX IS A **TORCH**
BEARER FOR
BRAINPORT'

opportunities

The playing field within which Sioux operates is fascinating. In high-tech, we see opportunities in what does not yet exist and seek to turn that future into reality. Moreover, in order to seize those opportunities, we are constantly pushing boundaries in technology, knowledge and applications. Our motivation is to make the world a better place: safer, healthier, more sustainable and more comfortable... All of that is reflected in the stories in this edition of Source, for example in the story of the promising start-ups in medical technology, that we are supporting as a development and manufacturing partner and sometimes also as an investor.

Nemo Healthcare spotted an opportunity to improve the safety of mother and child during pregnancy and child-birth with the help of a revolutionary new monitoring system. Another young company we work with is Xyall. It is set to significantly improve the quality and speed of pathological processes with its automated solution for dissecting tumour tissue. And you can also read the inspiring stories of the students of Delft University of Technology who are turning their dream of enabling people with paraplegia to walk again into a reality with their exoskeleton.

Sometimes, seeing opportunities and seizing them is also a case of literally stepping across frontiers. Sioux wants to remain relevant: it can only do so through further growth in terms of size and knowledge. The Netherlands is too small for that. For this reason, we have opened new locations in Southern Germany and China this year.

We are joining high-tech clusters in those countries where we can be of great value, if only because a multidisciplinary systems integrator like Sioux is unique there. Therefore, it is an investment in our future, but also a splendid new adventure.

Hans Duisters
CEO Sioux Group



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Sioux opens locations in China and Germany

‘PIONEERING IS IN OUR BLOOD’

Anyone familiar with Sioux, knows that the company is always in motion. What started out in 1996 as a software house is now, in 2019, a well-established technology house. Over that time, it has grown significantly in terms of competences, people and market position. The next logical step is internationalisation: Sioux recently opened its doors in Germany and China. CEO **Hans Duisters**: ‘We will always continue to push our boundaries, out of necessity but also simply because it’s fun to do so.’



Hans Duisters and Arnoud de Geus (from left to right) >

A photograph of two men in business suits walking towards the camera. The man on the left is wearing a grey suit and a red patterned tie, pulling a red suitcase. The man on the right is wearing a dark blue suit and a light blue shirt, pulling a brown suitcase. They are both smiling and looking at each other. In the background, there is a large glass building with a 'welcome' sign in white letters. Other people are visible in the background, including a woman in a red top looking at her phone.

China is buzzing; Sioux wants to be part of that

Sioux supports high-tech OEMs throughout the process of developing and constructing complex modules and machines. The company's ongoing development in that field is remarkable and is based first and foremost on great ambition and entrepreneurship. At the same time, it is the result of listening carefully to the market, says Arnoud de Geus, director new business development at Sioux.

International expansion

'Smart software is becoming ever more distinctive for the performance of high-tech equipment. Nevertheless, as a first tier supplier, you don't make enough of a difference for your clients with smart software alone. They want partners who add quality, shorten time-to-market and can deliver at the best price. If you want to be a company like that, you need to offer integration and an efficient transfer from design to delivery. Therefore, we have invested heavily in that, for instance by adding a specialist in optomechanronic prototyping, an assembly company and back offices in Vietnam and Romania. That has brought us to the point where we are now. Sioux is a fully-fledged systems integrator with extensive expertise in software, electronics, mathware and mechatronics. We focus on four markets: the semicon, automotive, medical and analytical industries. Now it's time for the next step: international expansion.'



‘We have made a flying start in Suzhou’

'We are careful to preserve what we have built'

Spreading risks and growing

Duisters moves to Suzhou in China early 2018 to set up Sioux's new location. The acquisition of the German company 4 Plus follows just a couple of months later. Sioux will be rolling out its broad range of services in both countries. There are various reasons for these international moves.

De Geus: 'We are careful to preserve what we have built, if only because by now more than 700 people and their families depend on it. However, if we want to remain a strong player, we have to spread risks and continue to grow. Brainport is too small for that. Based on that realisation, it is logical to look to Germany. Southern Germany has a strong cluster of machine constructors. What is lacking is a multidisciplinary solution provider. The opportunities for us are therefore clear. However, it wouldn't make sense to start from scratch there. That is why we opted for a takeover. We started out with a list of 260 companies and whittled it down until 4 Plus emerged as the ideal candidate.'

Perfect fit

4 Plus – now renamed Sioux Technologies GmbH, Erlangen – numbers around sixty people and specialises in the development of high-end electronics and software. In addition, the company has the people-centred culture and creative bent that characterises Sioux. Moreover, it is strong in the market for medical equipment. This creates more balance in Sioux's revenue distribution across customer segments, a strategic objective that is also being pursued by means of focused investment in large and small OEMs through the Sioux Tech Fund.

'So all in all, you can definitely describe us as a perfect fit', says De Geus. 'Now it's important to work on the integration with the mother ship, for example with regard to our working method, delivering our total proposition and the cooperation between our companies. That's why I currently spend much of my time here as Geschäftsführer. It's very rewarding work, not least because of the enthusiasm and dedication of our new colleagues.'

Dizzying

In addition to his work in Germany, De Geus travels back and forth to Suzhou every three months to make his contribution to setting up a Chinese Sioux location. Duisters has been living there for a year now. He headed over with high expectations.

'Pioneering is in our blood and this country is buzzing with energy. The economic and technological developments in Suzhou are dizzying. Sioux wants to be part of that because we can add value, for example in terms of quality awareness and integrated thinking and action. There simply is no company here like Sioux. But we can also learn a lot here; in some knowledge domains, China already has a significant lead over the rest of the world. Over the past year, we have worked hard to create a good foundation. For example, all the legal work, setting up an office and taking care of the payroll. In addition, we have established collaborations with important partners here.'

Photonics

One of Sioux's important Chinese partners is JITRI, an impressive R&D institute, similar to the Netherlands Organisation for Applied Scientific Research (TNO) but

bigger. It is looking for a partner to industrialise technology and take it to the market. At the same time, it represents an enormous source of knowledge and talent.

Duisters: 'For us, that is a great combination, and not just from the point of view of bringing in orders. For instance, this collaboration will allow us to embed a new competence at Sioux: photonics. A second leading partner is the government of Jiangsu. It is facilitating us in many areas. Partly as a result, we have been fully operational since April 1st and already have 25 people working here. We will be doubling our capacity within the near future. The first orders from existing and new customers have since then been received. For instance, we are working on an AI solution for a company that drills around 50 tunnels a year through the mountains of China. They need to check the direction every six metres. Sioux will be automating that time-consuming activity. In addition, we are working on the development of technology that recognises the type or types of wool in a garment. That is currently still done by visual inspection, a laborious process that a large number of people here in Asia spend an unbelievable number of hours working on. There are many more examples of new projects we are embarking on now and in the near future. In other words, we have made a flying start. China will bring Sioux a great deal, I'm convinced of it.' ●


Sioux and Novi Sad University join forces in European project

BIG DATA IS INEXTRICABLY LINKED TO THE RISE OF INDUSTRY 4.0

In 2018, seven BIGMATH PhD scholarships were granted to four European universities. **Greta Malaspina** from Italy was one of the lucky ones to make it through the selection. She conducts part of her research at Sioux under the supervision of **Lense Swaenen**, technology manager at Sioux's Mathware Competence Centre. 'This is a fantastic way to deepen our relationship with the academic world, to gather knowledge and to help Greta with her research and her career.'

BIGMATH - "Big Data Challenges for Mathematics" is part of the Marie Curie European Industrial Doctorate subsidy programme. It stimulates PhD candidates to further develop their skills within the business community. In this way, Europe wants to help retain talented scientists and generate and implement valuable knowledge.

Excelling

'I am extremely proud of our participation in BIGMATH', says Natasa Krejic, professor of Numeral Mathematics at Novi Sad University in Serbia. 'Less than 10 percent of the project proposals are awarded European funding. The most important thing is the combination of excelling in' 



Big data optimization
makes a difference
in the high-tech of
the future



academic skills and responding to a challenging research request. Cooperation with a relevant company is crucial, so it wasn't a coincidence that we ended up with Sioux. We have known the high-quality mathematics department for a long time through the Eindhoven University of Technology. And there is something else that makes me happy. The BIGMATH project stands out because of the high number of female scientists involved: no less than five in seven PhD candidates, with an equal ratio among academic tutors.'

Industry 4.0

As greater challenges are being solved with increasingly complex technology, the importance of big data applications grows. We use them more and more for various tasks, such as creating maximum efficiency in logistics processes, stock management and Computer Generated Imaging.

Swaenen: 'Big data is also inextricably linked to the rise of Industry 4.0. Automation and connectivity are the backbone of production processes, machines and applications of the future. Sensors have been developed that are able to distinguish over 1,000 colours. Even when analyzing a small image, for example from an electron microscope, we could be talking about col-

lecting and processing a huge amount of data. There are countless other examples - among other things in the field of machine monitoring and testing. Here, optimization using big data mathematics makes the difference in high-tech. That is why Sioux invests a lot in this field. Working together with knowledge institutions is one of the ways for us to achieve more depth through knowledge.'

Huge task

Greta Malaspina obtained her master's degree in maths at the University of Florence. The next three years, she will be working on the BIGMATH project that should result in her PhD. Recently, she set to work at Sioux, where she is focusing on a current project for Kadaster, the Dutch land registry.

'Dutch cadastral maps - approximately five million of them - are manually made sketches. They contain all sorts of elements, such as numbers, lines and texts. Until now, the challenge for Sioux has primarily been in automatically recognizing, analysing and digitizing individual maps. A current/future challenge is to stitch these millions of maps together, which can be considered a mathematical optimization problem with about 1 billion variables. That is a very complicated process

and, pre-eminently, the domain of big data mathematics. To me, this case is particularly interesting as a stepping stone for my research. At the same time, it is fascinating to have a chance to work outside the academic world, in a company culture with a very different kind of people. So far, I am very pleased.'

New theory

Given the major and complex task that Malaspina is facing, the question is justified when her work can be called successful. Her tutor Krejic has a clear answer to this.

'Greta passed a particularly thorough selection. There are no doubts about her skills and passion. The same goes for the qualities of Sioux. The cooperation is pleasant and we set the bar high because we have a shared interest. However, a PhD is quite something. We are expecting a thorough new theory and methodology in the knowledge that general big data mathematics can be applied to all kinds of specific problems.' 'At the same time, it would be great if Greta can, in fact, make a significant contribution to our Kadaster project', Swaenen adds. 'Perhaps the click between us will be good enough for her to eventually stay. That would be fantastic, of course.' ●

SamanTree Medical

‘WE ARE SETTING A NEW STANDARD IN TUMOUR SURGERY’

These are exciting times for **Bastien Rachet**, CEO of Swiss firm SamanTree Medical, which he set up in 2014 together with **Etienne Shaffer**. Their Histolog[®] Scanner, which can be used to identify cancer tissue in real-time during operations, is ready for the market, heralding a revolution in tumour surgery.

What is the problem you are tackling?

‘The challenge in tumour surgery of removing the cancer tissue while preserving as much of the healthy tissue as possible. The final pathological evaluation of the tissue margins always takes place afterwards. At that point it is not unusual to find that further surgery is required.’

How common is that?

‘Take breast cancer. In the US and Europe, 500,000 lumpectomies are performed every year. In a quarter of all the cases, a second operation may become necessary because cancer has been spotted in the margin. This impacts the patient physically and mentally. It also costs a lot of money, about 2.7 billion dollars per year globally. We are willing to improve that.’

How are you going to do that?

‘SamanTree is bringing confocal microscopy to the operating theatre. With our

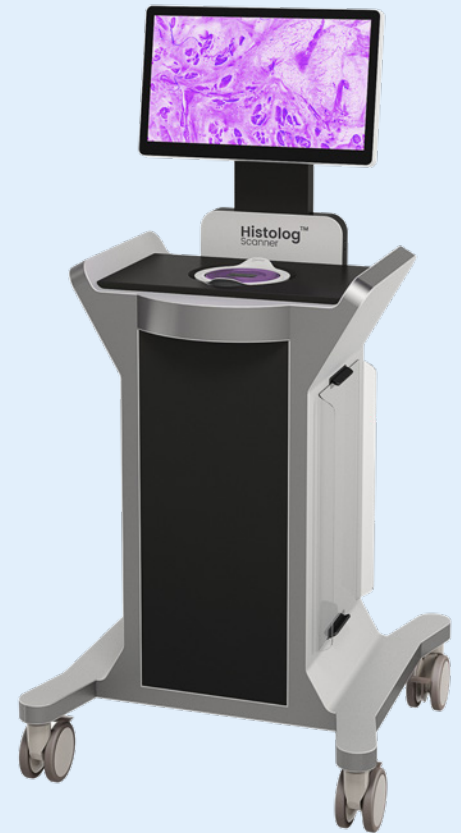
Histolog Scanner, cancerous tissue can be identified quickly and easily during surgery. You dip a sample in a staining medium and place it on the imaging window. Within minutes, you see a digital high resolution image at subcellular level. This will help surgeons to remove tumours with greater confidence and precision.’

What was the technological challenge?

‘The relatively large tissue samples have to be scanned and analysed in a short space of time. That places high demands on the system, for example in terms of data management – a specialty of Sioux which has become an important partner for us.’

How did your partnership originate?

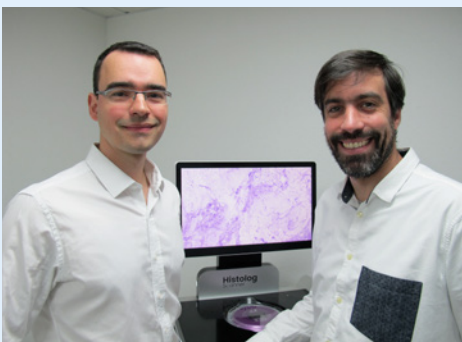
‘We were looking for a reliable production partner and came across Sioux. It really clicked between us and we realised that



Sioux could bring much more to the table. Besides manufacturing, Sioux is now our first partner for industrialisation and R&D in the field of data analytics. Moreover, the Sioux Tech Fund invested more than three million euros in SamanTree, which enables us to speed up the commercialization.’

What point are you at now?

‘The market roll-out has begun. We are setting a new standard for tumour surgery. The first step will be to win over early adopters. Our scanner is not an iterative development but a disruptive technology, we are aware that acceptance is going to take time.’ ●



‘Sioux have enabled us to speed up the commercialization’



Maarten Meulen and Aard Tuenter (from left to right) ^

‘We are always there
for each other’

Sioux engineers new controller
for VB-Airsuspension

SAFETY IS EVERYTHING IN THE AUTOMOTIVE INDUSTRY



Particularly intensive – that’s how **Aard Tuenter** of VB-Airsuspension and **Maarten Meulen** of Sioux describe their collaboration to develop an advanced air suspension controller for light commercial vehicles. The high standards for technical and functional safety, in the automotive sector in particular, drive the complexity of the process and the technology.

‘The bar is set high and that frequently generates considerable pressures within the project’, says Tuenter. ‘But we are always there for each other and you can see that in the result.’ ●

VB-Airsuspension was founded in 1993. There was a growing demand in the market for commercial vehicles for greater comfort, better handling and improved safety. Air suspension can make a significant contribution to that. Whereas this technology was already being deployed in the heavier segment, the drivers of light commercial vehicles still had to deal with 'dumb' mechanical systems. The founders of VB-Airsuspension saw a gap in the market and rushed to fill it.

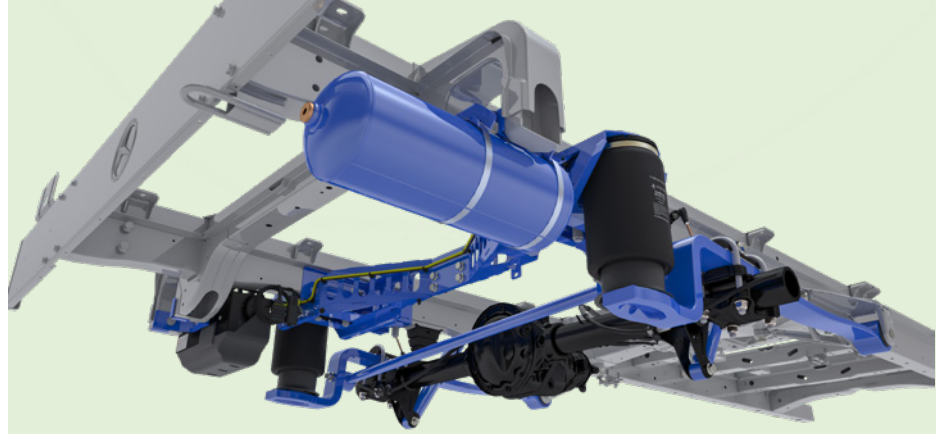
Pursuit of innovation

VB-Airsuspension is the European market leader in its niche. The firm serves both OEMs and the aftermarket. Its products are used worldwide in light vans and minibuses, but also in special vehicles such as ambulances, camper vans and Wheelchair Accessible Vehicles.

'We derive our raison d'être from our collaboration with customers and from our technological lead', says Tuentler, R&D manager at VB-Airsuspension. 'The automotive market is always in motion. New models are constantly being introduced and the degree of innovation is high, especially in the market for commercial vehicles. That is partly due to the high expectations of users and increasingly stringent regulations. It means we have to innovate constantly. We recently took a big stride in that regard with the development of a new Electronic Control Unit (ECU) for complete air suspension systems. We decided to work with Sioux on that, due to their expertise in integrated software and electronics solutions for the car industry.'

Interaction

The air suspension controller may be regarded as the heart of VB-Airsuspension's technology. It monitors and controls the various components of the complete air suspension system, such as compressors, valve blocks and sensors. It is precisely in the interplay of these components that there are opportunities to improve the handling and stability of a vehicle and create new functionalities – for example, raising and lowering the access to the car and loading ramp.



'The demands are high, both in terms of quality as in speed'

Tuentler: 'So it is a high-tech device that allows VB-Airsuspension to set itself apart. However, we have been building on our original product for 25 years. For this reason we began developing an advanced new ECU in 2016 and contracted Sioux to do the engineering for us. This project revolved around safety, and with good reason. In the automotive sector, critical technologies such as airbags and brake systems need to comply with the most stringent Safety Integration Level. The requirements for air suspension are only slightly lower: in the ASIL C category. That's not surprising: if something goes wrong here, it can really go wrong. If the handling of a vehicle suddenly changes, that can result in accidents and potentially serious consequences for users and manufacturers alike.'

Sector-specific requirements

The required safety certificate has had a huge impact on the development of the suspension controller. It began with laying down the technical and functional safety requirements in detail in accordance with the ISO-26262 standards for developing software and electronics in the automotive sector.

Maarten Meulen, project manager automotive: 'That means that for each step in the process, from concept and design through to testing and manufacturing, you make use of strict procedures and methodologies. These are primarily aimed at systematically identifying safety risks and ensuring that they are adequately addressed. So, for example, everything needs to be extensively recorded in documents and there is a strong focus on

testing. Naturally, we are familiar with that within Sioux's automotive department. The ECU for VB-Airsuspension is absolutely not a straightforward product. Safety is everything in the automotive sector and it has therefore had a substantial impact on this project. For example, the safety-critical part had to be executed with built-in redundancy. The dual-core microcontroller is configured in lock step, which means that all the instructions are executed and checked in parallel. In addition, with a view to the many components that need to work together within an air suspension system, all kinds of diagnostic mechanisms have been built in. This makes it possible to detect any software or hardware errors and make sure the system automatically reverts to a safe setting.'

Fixed fee

Following a development process lasting three and a half years, a prototype of the new air suspension controller is ready. It will be tested and developed into a complete product next year.

'During this project, there was considerable time pressure', says Tuentler. 'The demands were high, both in terms of quality as in speed. What's more, Sioux works for a fixed fee. The consequence is an intensive partnership. We are always there for one another. I've never had the feeling of being part of a customer-supplier relationship in which everything has to be done exactly according to the rules. Our partnership is based on trust, transparency and working towards a common goal. That's really great, and it has absolutely contributed to our success.' ●

Medical Technology

'A REVOLUTION IS COMING'

Medical technology is moving forward in leaps and bounds. With the help of intelligent systems and robots, more and more analytical and surgical procedures are being automated. 'Among other things, that progress is coming from high-tech machine manufacturing and advanced software', says **Maarten Steinbuch**, Professor at Eindhoven University of Technology. 'And that is an explicit strength of our region.'

What explains that speed of innovation in the field of healthcare?

'Costs are rising exponentially and there are too few employees available. Technology offers a solution in terms of both care and cure. For example, care and operation robots, but also applications for remote care and the detection of conditions.'

What is your faculty working on?

'Robotics research. Our showcase is the Tech United football team; five autonomous robots that have won the World Cup several times. We apply the knowledge and experience we gain from that to our care robots, AMIGO and SERGIO. Our faculty also has various spin-outs in surgical robots.'

What are they?

'Preceyes and Microsure, to name two. The machines help doctors to work more accurately and quickly, the former in eye surgery, the latter in vascular surgery. They are living proof of the revolution that is coming in medical technology.'

What is the core of the med tech of the future?

'It is semi-autonomous, intelligent, precise and reliable. Creation calls for the integration of wide-ranging expertise in the fields of machine manufacturing, data processing and software design.'

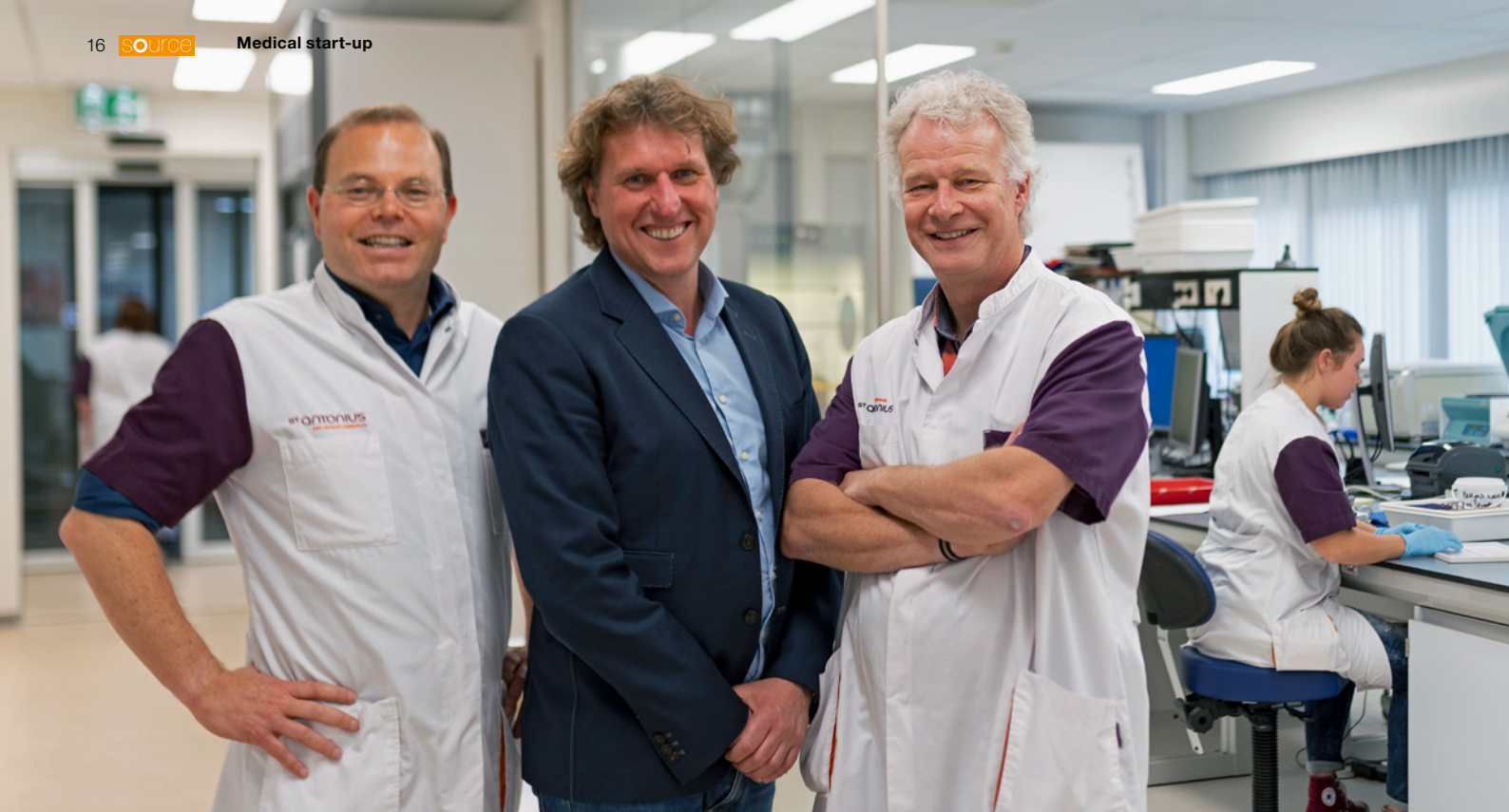
How do you see Sioux in this context?

'As a torch bearer for Brainport. Sioux excels in things like rapid prototyping, AI and data modelling. It regards the medical industry as an important market and underlines that by investing in promising start-ups such as Xyall and SamanTree Medical.'

You are also a person who sees opportunities and seizes them...

'You're talking about the recent launch of Eindhoven Medical Robotics. Together with my fellow founder Anupam Nayak, we're going full speed ahead with that over the next 10 years. Our first product is a milling robot for operations on the head. In 10 years time, we want to be the world leader in our market.' ◉





Sioux Tech Fund helps Xyall take off

‘WE HAVE A WORLDWIDE SUCCESS ON OUR HANDS’

In August 2018, Xyall began developing an automated system for the dissection of tumour tissue for molecular diagnostics. This will significantly improve the quality of the molecular pathological process while saving time. Less than a year later, the proof of concept has been delivered and the prototyping phase is beginning. ‘We are making good headway, thanks to the capital injection and technological contribution from Sioux’, says CEO **Guido du Pree**. ‘I am convinced we can go to market within two years.’

Molecular pathology is taking on an ever more prominent role in diagnosing conditions, and cancer in particular. Before the DNA and/or RNA analysis can begin, the tumour tissue first has to be selected and separated from the normal tissue. That time-consuming and manual process is also sensitive to human error.

In order to ensure that the automated system fits seamlessly within the working method of pathology laboratories and is able to handle all kinds of tissue types, Xyall has entered into a clinical collaboration with Pathologie DNA, a partnership between the pathology departments of three Dutch hospitals: Jeroen Bosch (Den Bosch), St Antonius (Utrecht and Nieuwegein) and Rijnstate (Arnhem). Together,

they represent a little under 20 percent of the national market.

Life or death

‘Our capabilities are improving all the time’, says Adriaan van den Brule, clinical molecular biologist in pathology. ‘In the past, we would look at some tissue under a microscope in order to determine whether the patient had cancer or not; whether they would live or die. However, the treatments and our understanding of DNA mutations and RNA expressions are improving exponentially. As a result, it is possible to determine for more and more types of cancer which approach best suits a specific case, based on a genetic profile. These days, we can even follow escape mechanisms at a molecular level, which means we can enable doctors to adjust their therapy during the course of the disease. The flipside of this progress is that our work requires more time and money. For example, new research methods demand ever higher quality of the



◀ Henk-Jan van Slooten, Guido du Pree and Adriaan van den Brule (from left to right)

the 'Regions of Interest' – the parts with tumour cells that need to be examined – on the coloured slides. Finally, the laboratory technician cuts these out on the non-coloured slides. All of this is done manually and by visual inspection. That has its drawbacks. Firstly, it is too arbitrary and inaccurate, particularly in view of the contemporary demands made of molecular diagnosis. It is also time-consuming, for example because no single sample from a series is positioned in quite the same way and so you cannot copy them just like that, but also simply due to the large volume of diagnoses we perform. Moreover, there is a risk of cross-contamination during the entire process. Plenty of reasons, then, for us to support Xyall in developing an efficient, consistent and reliable system to automate the process.'

samples we work with. That means the pressure on our workflow is growing tremendously.'

Manual work

Clinical pathologist Henk-Jan van Slooten: 'One factor behind our collaboration is the increasing demand for high-quality diagnosis and up-to-date techniques. In our profession, 80 percent of the work is still done by hand. That is particularly true for the preparatory phase in our laboratories.'

'In our profession, 80% of the work is still done by hand'

In the case of molecular diagnosis, we obtain between one and six preparations from a tumour per case. We cut them, place the tissues onto pathology slides and mark the two outer ones with a contrast medium in order to calculate the percentage of tumour cells. We then indicate

A business worth millions

Xyall was founded by Guido du Pree and Hans van Wijngaarden. They were supported with capital from the Sioux Tech Fund, which was set up to bring promising knowledge and technology under development by firms and research institutes to market.

Du Pree: 'We were no strangers to one another. Hans and I had previously worked together on the Philips Digital Pathology venture within the Philips Healthcare Incubator. Among other things, we were responsible for developing a digital system for archiving, calling up, viewing, comparing and sharing pathology samples there – a project which Sioux also collaborated on. That is now a business worth millions. We also saw a large and global demand for automation of the front end of the pathology process. Because Phillips didn't want to go further down that road, we decided to take it forwards together and in doing so turn our entrepreneurial dream into reality. The preparations took several years. In 2018 we set up Xyall as a lean asset OEM, with Sioux as a shareholder and partner to take the complete development and manufacturing process out of our hands.'

Feasibility and prototyping

Xyall's Automated Tissue Dissection System will be able to scan and store a series

of preparations in a resolution of 50 microns, once it is fully developed. The pathologist will then mark the Regions of Interest with the help of an advanced tool and they will be directly transferred to all the slides. Next, a robot will scrape away the selected tissue samples using disposable knives which will be changed for every slide. With the help of pneumatic transport, they will be stored separately in containers for later molecular examination.

'So we're talking about a machine that detects, moves and positions with a very high accuracy', says Du Pree. 'Moreover, it can process more than 60 samples per hour; quality control is built-in as standard and the risk of cross-contamination is less than 0.01 percent. This development therefore requires huge expertise in technological domains such as optics, mathematics, motion control and data processing. Even so, we managed to complete our feasibility study within a year, not least because we were able to call on the help of Sioux which, alongside the necessary know-how, also has the experience to create a complex device like this based on an integrated approach. We are now embarking on the prototyping phase. That will require a new funding round, in which several bigger innovation funds will also be involved. Again, we are going to be moving quickly in this phase, with Sioux as our technology partner. I am convinced that we have a worldwide success on our hands and that we will be able to go to market within two years.'

Clear picture

Van den Brule: 'We fully agree with this. We provide our input from Pathologie DNA, for example in terms of functional requirements and alignment with our workflow, and later as testers of the prototype. All the stakeholders have a clear picture of what the end result is supposed to be. We know it's possible. But we also know that it can be done quickly, and that is particularly important to us. After all, this technology is going to bring great benefits for laboratory technicians and pathologists. And of course those benefits will trickle down to the rest of the medical chain, the hospital organisations as a whole and the patients.' ●

Eria Lopez

'SIOUX FEELS LIKE FAMILY'



The story of **Eria Lopez** is one of exploring boundaries, both literally and figuratively. She quit her job as a software engineer at Intel in Mexico and enrolled in a computer sciences course in Paris. After having successfully completed this course, she came to work at Sioux. She has not regretted that decision for one moment. 'I feel genuinely at home here and not a day goes by without learning something new.'

When she was only 14 years old, Lopez already knew exactly what she wanted to become. One day, she wanted to be an engineer and move abroad. This is not an ordinary ambition for a Mexican girl, but she persevered and made her dream come true. She has been working as a software engineer at Sioux for almost three years now.

Cool and passionate

'I got offers from various European companies', Lopez says. 'Sioux stood out, firstly because of the many open and passionate people I spoke with. Secondly, I thought the projects were simply cool. They often result in a tangible pioneering machine rather than remaining just a piece of hardware or software of which almost nobody suspects it exists. Right from the start, it became clear to me that Sioux was really interested in me and my talent and that they wanted to invest in me.'

Smart and creative

At Sioux, Lopez focuses on the development of firmware for high-tech modules and machines. She characterizes her job as a complex one. 'We continuously conquer big challenges in multidisciplinary teams. This means I am not just typing in code all day long. I get to share my ideas about innovative technical solutions with people I look up to, because they are extremely professional, smart and creative. I learn a lot from them. On top of that, I have an annual training budget that helps me improve my skills. All in all, my work revolves around growth and development. But we also have fun and we enjoy what we do. To me, Sioux feels like family and the Netherlands is my new home.' **Q**





‘Not a day goes by without learning something new’



Sioux develops and manufactures NFMS for Nemo Healthcare

‘THIS IS A **BREAKTHROUGH** IN MEDICAL TECHNOLOGY’

In 2018, decades of stagnation in cardiotocographic innovation came to an end. Nemo Healthcare launched a non-invasive portable system for monitoring the unborn child during pregnancy and childbirth. This milestone was preceded by more than a decade of fundamental research. The Nemo Fetal Monitoring System (NFMS) itself was developed in just two and a half years. ‘Collaboration with Sioux was crucial’, says **Will Ickenroth**, VP Business Development at Nemo Healthcare.

A revolution in obstetrics is how Ickenroth rightly describes the NFMS. After all, not every birth passes off without complications. For example, the rate of Cesareans is still high in some European countries. During pregnancy and childbirth, monitoring – obtaining up-to-date information about heart rate and uterine activity – of mother and child is very important for early diagnosis and optimum intervention by gynaecologists and obstetricians.

Signal quality and infections

‘There are two ways of monitoring’, explains Ickenroth. ‘The non-invasive method uses Doppler ultrasound to mea-



◀ Will Ickenroth and Koen Smits (from left to right)

Technology began collaborating closely on fundamental research in the realm of electrophysiology. This collaboration resulted in Nemo Healthcare. The development of the NFMS began in 2016. Sioux provided the complete electronic, software and mechanical design and prototyping and is now manufacturing the system.

Stringent requirements

So the NFMS was brought to market in two and a half years', emphasises Koen Smits, senior account manager at Sioux. 'That is remarkable in view of its complexity but also from the perspective of feasibility and cost. Moreover, the medical domain is subject to stringent requirements in terms of safety and reliability. Support during certification is always an important process. Sioux has all the necessary disciplines in house. We can bring them together in an integrated medical solutions development process that meets the ISO-13485 requirements. Additionally, we can count on our ALLISON platform, which combines a number of high-quality electronic and software standard solutions and so contributes to achieving the required development speed and product quality.'

'And don't forget that working together as intensively as this depends on people', adds Ickenroth. 'There are always ups and downs. Transparency, perseverance and talking things through at all levels are crucial. You need to literally and metaphorically be there for one another. To a large extent, daring to take risks together, having the feeling that "our success is their success" and wanting to contribute to a better world determine the result. I see those qualities very strongly at Sioux. This is also the foundation of our future. The NFMS is only a first step and offers opportunities for new applications. I want to pursue that path with Sioux.' ●

The medical domain is extremely high demanding

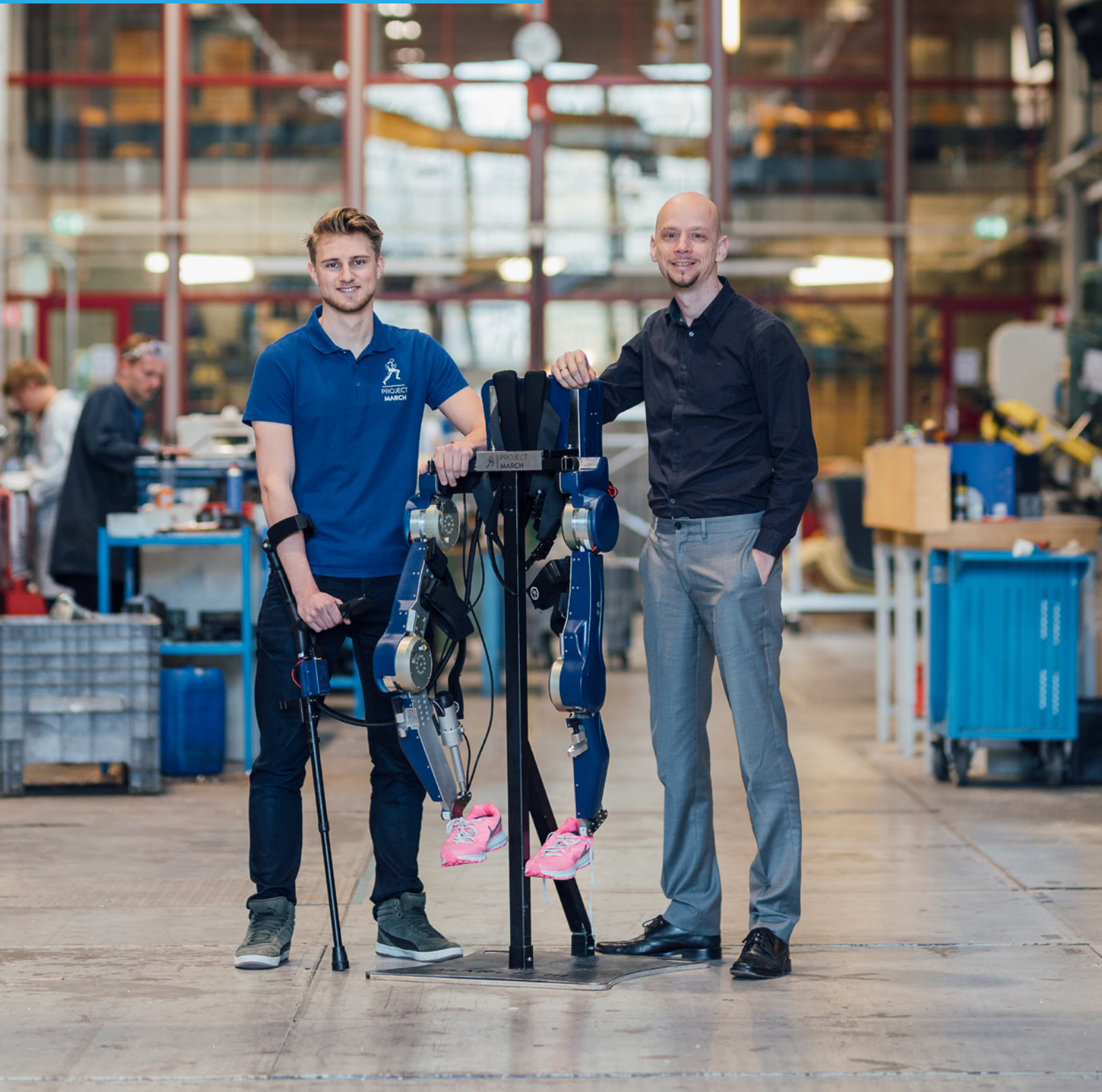
sure the heart rate of the child and a tocodynamometer to measure the contractions. However, the signal quality often leaves a lot to be desired, especially if the mother has a high BMI. The bands which are fitted tight around the belly feel uncomfortable and the measuring units have to be moved regularly as the child moves. The invasive method uses a scalp-electrode for heart rate measurement and in some countries an intrauterine pressure catheter to record contractions. Although this approach is seen as the gold standard, it does involve risk, such as the risk of

infection. The NFMS replaces both methods and the quality of the measurements is comparable with the best. The system is non-invasive, BMI-independent and easy and comfortable to use. Moreover, it is wireless: you can walk around with it and even take a shower. We really are talking about a breakthrough in medical technology.'

Algorithm

'The NFMS consists of several elements. The Nemo Patch that is applied to the abdomen contains six electrodes and a holder for one of the two Nemo Links. The latter sends the collected data to the Nemo Base that converts the data into relevant information in real time. The NFMS actually measures all the electrophysiological signals. Its technological core is a smart algorithm that calculates the foetal and maternal heart rate and uterine activity from those signals. At the start of this century, the Maxima Medical Center and Eindhoven University of

‘We want to make the world a better place with the help of technology’



Sioux supports Project March

THE ULTIMATE AIM IS COMPLETE CONTROL

Giving paraplegics their mobility back – that is the dream that drives Project March. In order to turn it into a reality, students at Delft University of Technology are developing and building an exoskeleton. The project has now been underway for four years. They have recently started receiving help from Sioux. ‘That wasn’t a difficult decision’, says **Ronald de Leeuw van Weenen** of Sioux. ‘It’s a fantastic goal and the technological fit was very good.’

Project March is a relay race. Every academic year, a new group of students continues the work of their predecessors. They take a break from their studies to focus completely on further developing their exoskeleton. Rens Doornbusch is the current chief engineer of the team.

Unique opportunity

‘We are currently working with 23 people’, explains the industrial design student. ‘Improving the quality of life of people who are confined to a wheelchair due to paraplegia is very motivating. It is also a unique opportunity to gain experience together with fellow students from all kinds of fields – for example, IT, electronics and mechanical engineering – in creating a high-tech machine. We study the current technological and functional

status, decide what we want to improve and build the next version. In that way, we develop a completely new exoskeleton in the space of one year. After that, we hand the project over to a new team. That may sound like an inefficient process, but doing it this way means we learn a lot and it keeps us on our toes. It also provides direction to our work.’

Complete control

At the end of April, Rens and his colleagues announced their ambitions for this year. Their focus is on increasing the degree of freedom of the hip joints and the stability of the skeleton. Doornbusch: ‘The ultimate aim is complete control. More sideways mobility of the hip is essential for a natural gait. That motion can be used to generate greater control over the stride or, for example, to walk on a sloping surface. However, the big task is balance. Currently, the pilot of the exoskeleton still needs crutches to stay upright. That needs to change. The solution lies in the combination of high-end mechatronics, sensor technology and software. So it’s quite a challenge.’

Reviews and suggestions

Project March is supported by many public and private partners. Last year, Sioux joined them. ‘That wasn’t a difficult decision’, says De Leeuw van Weenen, tech lead at Sioux in Mijdrecht and Delft. ‘It’s a brilliant project and it suits us. We want to make the world a better place with the help of technology. We do that at our own strength, as a multidisciplinary systems integrator, but also by investing in promising initiatives by others. So the decision to make money and knowledge available was quickly taken. The latter would mainly involve our software expertise. However, today most of the questions are related to

mechatronics. They are answered by our colleagues in our mechatronics department, who do reviews and make suggestions relating to the approach and possible solutions. The collaboration is going very well. We also enjoy it. At the same time, the subject matter is complex, certainly when it comes to balance. That naturally prompts questions from our professionals in terms of the fundamental approach to technological development and the balance project. After all, their world is different from that of a student team. But you can learn from that too.’

Front-runner

In August 2019, the fourth generation of the Project March exoskeleton was delivered. According to Doornbusch, it will eventually be able to compete with products already on the market. ‘That is already the case, at least in many areas. We recently demonstrated that during the most recent edition of Cybathlon, an annual race over an obstacle course with participants from all over the world. We won in our category, which puts us among the front-runners.’

Alongside the annual competition, every four years a big Cybathlon is held. The team is currently working towards the big Cybathlon competition that will be held in May 2020 in Zürich. Thirteen other teams have already registered for the event. After the competition in 2020, it is up to the next teams to decide how the project will continue to develop. What subsequently happens with the knowledge – a spin-out, selling it off in components or putting the information into the public domain – is still fully open. For now, the focus is on learning and technological progress. ●

Sioux Technologies has all the expertise to contribute to the maximum success of high-tech products and production systems. Sioux's strength lies in the unique combination of high-quality competences in software, mechanics, optics, physics, mechatronics, electronics, mathware and final assembly & testing. With more than 700 engineers Sioux supports or forms the R&D department of leading high-tech companies. Sioux is keen to take responsibility: from creating ideas in the conceptual phase up to the delivery of serial production. Sioux wants to add value to its clients and build innovative solutions that can contribute to a society that is smarter, safer, healthier, more enjoyable and more sustainable.

For more information go to www.siox.eu

