Claudia Doyle

Eigene Ideen umsetzen

Gerüstbau und Pathologie – so unterschiedlich die Branchen sind, die zwei von Studierenden und Alumni der TUM gegründete Start-ups im Blick haben, so sehr ähnelt sich ihre Idee: Sie wollen fehleranfällige oder ermüdende Tätigkeiten automatisieren und damit effizienter und sicherer machen.

Mit KEWAZO entwickeln der Bauingenieur Artem Kuchukov und ein interdisziplinäres Team einen Roboter, der Menschen beim Gerüstbau assistiert und sie entlastet. Der Prototyp kann heute mit einer Geschwindigkeit von bis zu 26 Metern pro Sekunde vertikal am Gerüst entlangfahren und dabei bis zu 60 Kilogramm an Gerüstteilen transportieren. Sensoren erkennen, wenn Menschen oder Gegenstände den Weg versperren.

Das Start-up inveox will den Umgang mit Gewebeproben für die Krebsdiagnostik in Pathologie-Laboren automatisieren. Bislang müssen medizinisch-technische Angestellte unter anderem jeden Probenbehälter einzeln öffnen, das Konservierungsmittel abgießen und das Gewebe in eine Biopsiekassette übertragen, bevor die Probe unter dem Mikroskop untersucht werden kann. All das soll in Zukunft das System von inveox übernehmen und damit Verwechslungen oder Verunreinigungen der Gewebeproben verhindern. Die beiden Köpfe dahinter sind die Wirtschaftsingenieurin Maria Driesel und Dominik Sievert, der sowohl Molekulare Biotechnologie als auch Management an der TUM studiert hat.

Unterstützung auf ihrem Weg von der Idee bis zum Markteintritt erhielten die Studierenden und Alumni durch die Universität und UnternehmerTUM, dem Zentrum für Innovation und Gründung: Das Angebot reicht von kostenlosen Büroräumen über Beratung und Weiterbildung bis hin zur Hightech-Werkstatt MakerSpace und der Bereitstellung von Venture Capital.

Sowohl inveox als auch KEWAZO wollen noch bis Ende 2018 die Vorserie beim Kunden einsetzen, Feedback einholen und Verbesserungsvorschläge umsetzen. Dann wollen sie den nächsten Schritt wagen – die Serienproduktion. □

The name KEWAZO stems from the Greek word for “to construct” – the startup is developing a scaffolding robot for large construction sites. The team consists of TUM students and alumni Artem Kuchukov, Aleksandar Belberov, Alimzhan Rakhmatulin, Ekaterina Grib, Leonidas Pozikidis, Dmitry Chokovski, Eirini Psallida and Sebastian Weitzel (from left to right).

With their startup inveox, Maria Driesel and Dominik Sievert aim to improve the reliability of cancer diagnoses.

From Bright Idea **to Business Venture**

How can heavy construction work be made less labor-intensive? And how can the processing of tissue samples in histopathology labs be improved? With their business ideas, two start-ups are striving to answer these questions.

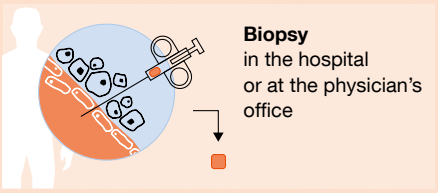
At half past eight in the morning, on the second floor of the Technology and Startup Center "gate" in Garching, Maria Driesel and Dominik Sievert stand with two engineers in front of a man-sized machine. Behind the orange plexiglass cladding, its interior bristles with cables, circuit boards and state-of-the-art technology. The team are discussing the latest modifications. Soon this device will enter series production, automating a complex and error-prone process: the transfer of tissue samples in histopathology labs.

Just one building further along, at the TUM Entrepreneurship Center, civil engineer Artem Kuchukov and his team are packing their laptops and office furniture into moving boxes. On their way out of TUM's startup incubator into bigger premises, they take along their robot, a knee-high, silvery cube. This prototype is designed to transport scaffolding parts and thus relieve people of heavy and repetitive physical tasks. With its robotic transport system, the startup KEWAZO wants to bring automation to the construction site.

While the industries targeted by inveox and KEWAZO are clearly quite different, the two startups founded by TUM students and alumni are very similar in the idea they want to bring to market. Both aim to automate hazardous or strenuous activities, increasing the efficiency and safety of workflows. ▷

Picture credit: Astrid Eckert/TUM

Cancer testing – the laboratory process



Biopsy
in the hospital
or at the physician's
office

Issuing and dispatching
the conventional way

Handwritten examination request + Conventional container

Courier to pathology laboratory

Issuing and dispatching
with inveox

Sample container with integrated filter + Digital examination request

Courier to pathology laboratory

Conventional sample entry
Manual process

Interpretation of handwritten examination request, manual data entry

Open lid and remove formalin

Mark biopsy cassette

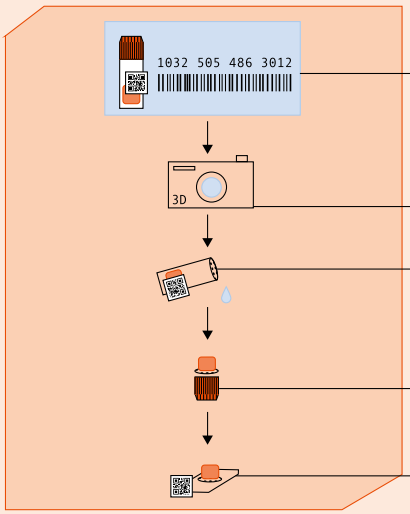
Basic sample description

Repack sample from container to biopsy cassette

Touch-free, automated sample entry
with inveox automation system

Processing of several containers at the same time

750
samples per hour



Register code, identify sample, unlock respective digital examination request

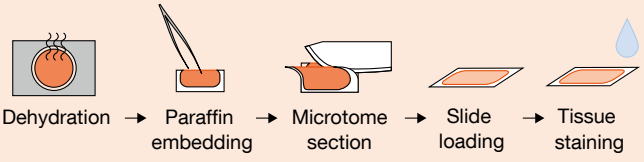
3D imaging: precise sample specification, documentation, quality assurance (QA)

Open lid, formalin disposal

Touch-free transfer of sample into filter, image for QA

Unite filter with biopsy cassette, engrave code into cassette

Further processing of the sample



Dehydration → Paraffin embedding → Microtome section → Slide loading → Tissue staining

Diagnosis and archive

In histopathology labs, tissue samples are tested for cancer, among other things. Sample entry is a critical phase here, because the manual tasks (left) of transferring and recording the sample are time consuming and prone to errors. In order to prevent mix-ups and contamination of tissue samples, inveox has developed a system (right) designed to automate this process.

Starting up

inveox

Startup venture inveox seeks to automate tissue sample processing in histopathology laboratories, preventing errors and reducing monotonous tasks for medical technicians.
The brains behind the operation belong to industrial engineer Maria Driesel and Dominik Sievert, who studied molecular biotechnology as well as management at TUM. Since its foundation in 2017, inveox GmbH has experienced a major growth surge, expanding from just three team members to 23 full-time positions, plus around twice as many student and part-time employees. Driesel and Sievert set great store by diversity here: Their team members come from eight different countries, with the oldest being 64 and the youngest just 18 years old. They also attach great importance to transparency and openness, discussing the company's current situation with their entire staff each week.
Their advice to other founders would be to build a network and use it extensively. Particularly when it comes to routine procedures and standard requirements, their view is that there's no need to reinvent the wheel every time – sound advice from experienced entrepreneurs can sometimes be invaluable and save on costly consulting fees.

Error-prone manual tasks

People quickly lose concentration when they have to repeat the same activity over and over again – and that is where mistakes can creep in. Machines, on the other hand, don't care whether they are performing a task for the first or one hundredth time. However, in many sectors, they have yet to gain a foothold.
Processing tissue samples is a case in point. Doctors take these samples to check for cancer, for example. The tiny pieces of tissue are first packed into small plastic containers filled with formalin, a liquid that fixates and preserves the samples. Medical technicians often just scrawl the patient's name on the outside of this container, which is then mailed to a laboratory with a handwritten examination request. Once there, the time-consuming manual process continues: The sample is opened, the carcinogenic formalin is carefully removed and the notes are deciphered. The sample is then repacked in a biopsy cassette and prepared for examination.

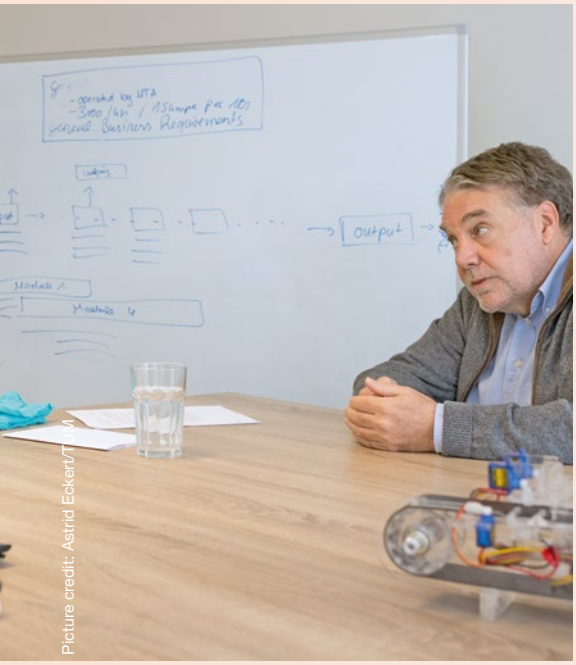
When a histopathologist explained this to Maria Driesel during a study period in the US, her first thought was that, in the 21st century, it could all be so much easier. "I immediately recognized the potential for innovation here," she recalls. With a background in industrial engineering, she previously had nothing to do with medicine. But as a "Manage & More" alumna, she had learned how to identify new business areas. This is a program offered by UnternehmerTUM, the Center for Innovation and Business Creation at TUM, to prepare students for executive positions.
Dominik Sievert, too, was concerned about the sample processing situation. His motivation is very personal: "My grandfather received a flawed cancer diagnosis," explains Sievert, who gained his Bachelor's degree in molecular biotechnology and went on to study management at TUM. Perhaps due to a number mix-up or illegible handwriting – the exact cause of the confusion remains unclear. But the topic has played on his mind ever since. ▷

Graphics: ediundsepp (source: inveox), picture credit: Astrid Eckert/TUM

Having outgrown the TUM startup incubator, the inveox team has found a home at the Garching Technology and Startup Center “gate”, a center for startups and young companies funded by the German state of Bavaria.

The two met during the “Manage & More” program in early 2015. By fall 2016 they were developing their business to automate the sample entry process in histopathology labs – initially squeezed in around their work and studies, and then on a full-time basis. They worked late into the night on their business plan and used modeling clay to make a prototype of their new transport containers for tissue samples – not pretty, but certainly practical. Next, they presented doctors and histopathologists with their concept and asked them for feedback. It quickly became clear that professionals in the field also found the idea promising – and, most importantly, feasible. “With that at the back of your mind, starting a business venture is no longer a scary prospect,” declares Sievert. ▷

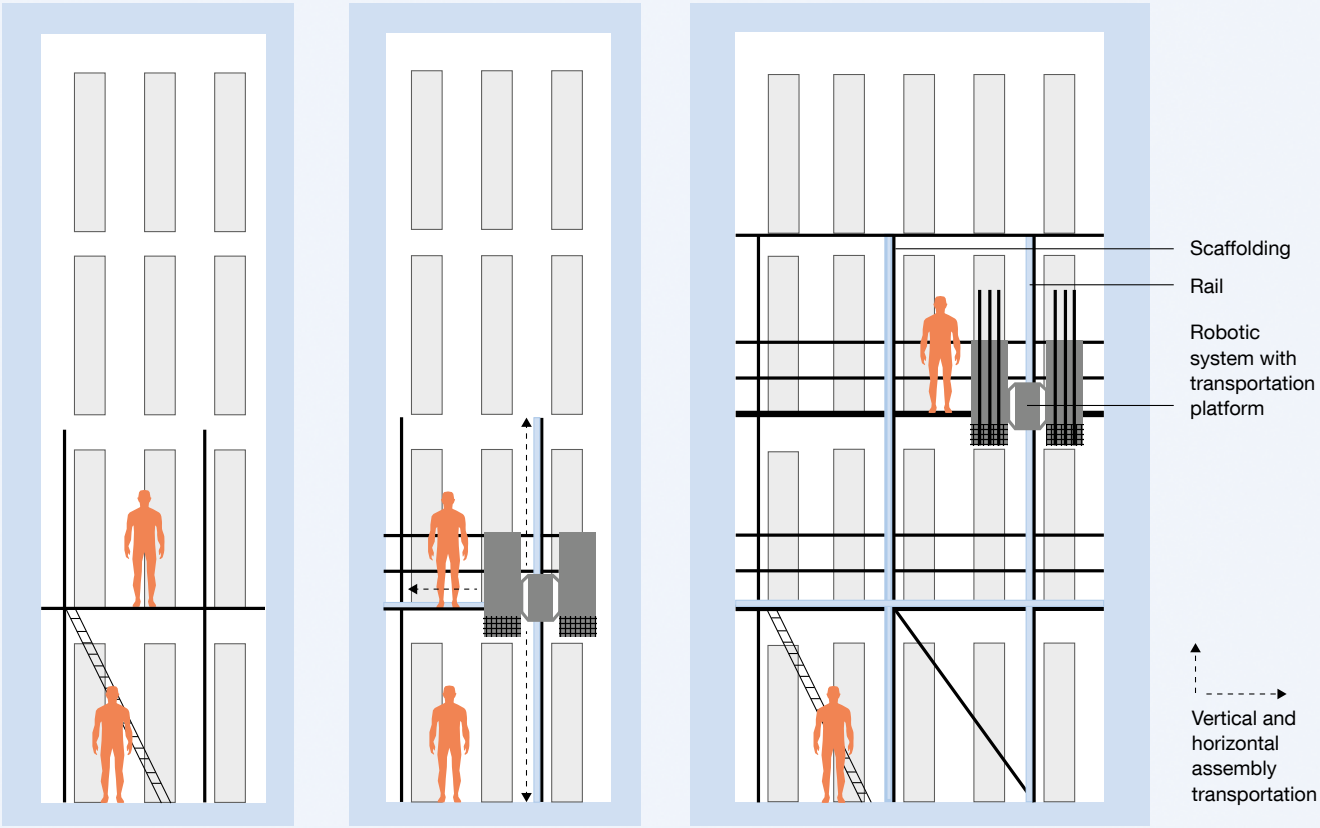
Maria Driesel (right) and Dominik Sievert (second from the right) and their team have been developing an automated entry system for biopsy samples.



Picture credit: Astrid Eckert/TU Dresden

"I was determined to create something new and take our idea all the way to market."

Maria Driesel



KEWAZO's robotic transport system is designed to transport scaffolding components from a storage point to an assembling point, thus saving time and effort. It can operate with only two workers. The control system is semi-automatic, with each scaffolder equipped with a small device that transmits their position to the robot via wireless communication. At the push of a button, the robot travels to the worker's location.

Robotic co-workers

Civil engineer Artem Kuchukov also early on sought out dialog with people working in the field. "Automating tasks on construction sites is a lot harder than it sounds at first," he points out. A construction site changes every day, but many individual areas are highly standardized. Scaffolding is a good example here: the parts have to comply with defined standards. A pipe has a diameter of 48.3 millimeters, and the individual components always connect the same way. Ideal conditions for robots – so Kuchukov decided to take on scaffolding first. Together with fellow student Leonidas Pozikidis, he took part in "Think.Make.Start" – an interdisciplinary seminar held by TUM and UnternehmerTUM for Master's students. There they found three more like-minded individuals for the KEWAZO team: Sebastian Weitzel and Eirini Psallida, both informatics students, and Alimzhan Rakhmatulin, studying Earth-Oriented Space Science and Technologies. The group of five spent two weeks working to turn the idea into an initial prototype: a robot to assist scaffolders and reduce the strain on them. They then immediately visited a trade fair for construction equipment and went from stand to stand, presenting their idea. Shortly after that, Ekaterina Grib joined the team – a student of consumer affairs at the TUM School of Management, who has supported KEWAZO with its business development ever since. One of the most important findings from the team's many discussions and site visits was that 80 percent of scaffolding assembly time is spent moving parts around. And while one person is hauling these parts, the others are held up waiting. The primary task for the robot is thus to transport scaffolding tubes and decks from a storage point to an assembling point. KEWAZO's next move was to apply for an EXIST Business Start-up Grant, part of a German government program to support technology- and knowledge-based startup projects. Kuchukov and his team were duly awarded funding and have been working on their venture full time since April 2017 – now as a team of six. ▷

KEWAZO's prototype of the scaffolding robot was put through its paces outside the TUM Entrepreneurship Center in spring 2018. Here, TUM student and KEWAZO co-founder Alimzhan Rakhmatulin checks the correct gripping of the prototype during operation.

"For hardware start-ups in Germany, Munich is the hub."

Artem Kuchukov

Starting up

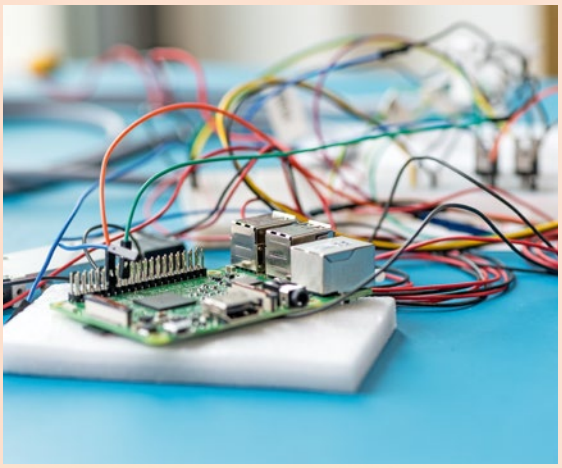
KEWAZO

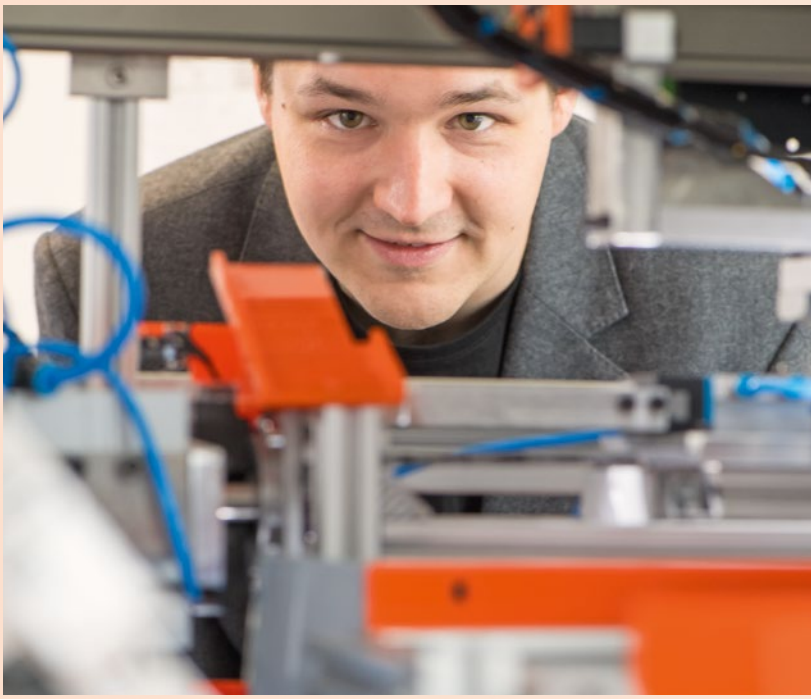
The KEWAZO team aims to bring automation to the construction site. Their robot is designed to assist in scaffolding assembly, relieving workers of heavy manual labor.

Since the beginning of 2018, the team of eight has been working on the implementation of the system. Their diverse backgrounds in the fields of civil engineering, computer science and economics complement each other perfectly. "Our contacts at various different chairs meant we received a great deal of support from TUM right from the start," acknowledges co-founder of KEWAZO GmbH, Artem Kuchukov (far left). From product development to looking for sponsors, TUM mentors were always on hand with a few tips for the venture.

As far as location is concerned, Kuchukov also feels Munich is ideal for starting a business: "In my view, for hardware startups in Germany, Munich is the hub – so you have the perfect network in place here," he confirms.

Graphics: ediundsepp (source: KEWAZO), picture credit: Astrid Eckert/TUM





At the center of inveox's business idea are the novel-design sample containers (center) as well as the automated sample entry system (above). As a third component, Dominik Sievert and Maria Driesel and their team are developing a web-based platform in order to facilitate the communication between physicians and histopathology laboratories.

End-to-end process automation

Among other scholarships and awards, an EXIST grant has also enabled the founders of inveox to focus fully on their venture since the fall of 2016. At that time, Driesel and Sievert joined the TUM's startup incubator – a facility that provides prospective entrepreneurs with work space and startup coaching. "Needless to say, my parents weren't exactly delighted when I resigned from my well-paid permanent position," recounts Maria Driesel, "but I was determined to create something new and take our idea all the way to market."

Picture credit: Astrid Eckert/TUM

The inveox product idea has long since evolved. While they originally set out to prevent sample mix-ups by offering intelligent containers, Driesel and Sievert are now seeking to automate the entire handling process. To this end, they developed an encrypted web-based data and communication platform that allows physicians to send the relevant data to the lab electronically, as well as checking on the current status at any time. They also designed a device to automate all of the steps previously completed by hand.

The initial concept has thus turned into the man-sized device now standing in the inveox workshop. Inside it, each tissue sample moves through an automated process. First, the device opens up the sample container and pours away the formalin used to preserve the tissue. Next, it automatically transfers the sample to a filter integrated in the original container. A laser beam then engraves a QR code and numerical code onto the cassette, ensuring the sample can always be uniquely identified. In the process, the tissue sample is photographed so that doctors making a subsequent diagnosis can still see what the tissue looked like prior to dehydration and staining. "Using automatic image recognition, our aim is also for the software to learn from these photos how to indicate healthy and cancerous tissue," reveals Driesel.

From office to high-tech workshop

While the inveox team decided to buy in various electronic and pneumatic components, they designed and manufactured the majority of the metal parts for their prototype themselves. To do so they were able to use MakerSpace, UnternehmerTUM's high-tech workshop, handily located just meters from the inveox office. If they were reliant on a service provider, the engineers and designers would have to wait around six weeks for a custom-made part. "As it is, we just pop next door with our plans and can mill the component within a few hours," Driesel enthusiastically explains. ▷

KEWAZO has benefited from this support ecosystem, too. During the founding phase, Artem Kuchukov's team was based at TUM's startup incubator. Here, they developed the prototype of their battery-operated robotic system. In spring 2018, the robot prototype was put to the test on the outside of a building for the first time. It glided along the scaffolding on rails, transporting scaffolding parts to exactly the right place at the right time. The prototype currently transports loads of up to 60 kilos at a speed of 26 meters per minute. The target is to reach up to 100 kilos with a maximum speed of 42 meters per minute.

The control system is semi-automatic, with each scaffolder equipped with a small device that transmits their position to the robot via wireless communication. At the push of a button, the robot travels to the worker's exact location. Sensors detect any people or objects blocking its path. While assembling a construction lift can easily swallow up an entire day, it takes just minutes to mount the robot on a scaffold.

Both inveox and KEWAZO aim to run pre-series tests with customers before the end of 2018, enabling them to gather feedback and implement suggested improvements. They will then be ready to dive into the next phase – series production.

Claudia Doyle

With the MakerSpace high-tech workshop just a few steps away from TUM's startup incubator, the KEWAZO team was able to manufacture parts for their scaffolding robot prototype themselves. This allowed them to constantly test, improve and modify their device.

Picture credit: Astrid Eckert/TUM