ROBOTICS
An innovation domain of the canton of Vaud
Innovation in robotics will significantly improve workplace efficiency and our quality of life. The canton of Vaud is driving advances in all sub-fields of robotics, while retaining focus on the connection between robots and humans.

The canton of Vaud has a rich history with robotics dating back to the early 1970s; its long tradition of watchmaking and micro-engineering turned the region into a vibrant hub for industrial robotics. Startups in other sub-fields of robotics are also flourishing thanks to the region’s academic excellence, favourable environment for technology transfer, strong interdisciplinary culture, and the lack of administrative barriers.

The region is a pioneer in mobile robotics, and thanks to the positive influence of the NCCR Robotics research consortium, it also excels in wearable and educational robots. Virtual reality, AI and other associated technologies also benefit from the canton’s unique, innovative spirit.

“We have good reason to believe that autonomous vehicles represent the future. The question is not if but when they will be part of our daily lives. It might not happen overnight, but we are definitely heading in that direction.”

HANNES BLEULER
Professor at EPFL
FROM STATIC TO MOBILE ROBOTS

Thanks to the lack of administrative barriers, the canton of Vaud is an ideal place for startups to run tests. BestMile is a famous example of mobile robot innovation.

Besides having the upper hand in industrial robotics, the canton of Vaud has also seen the emergence of many startups in other sectors of robotics. BestMile is a famous example of mobile robot innovation. Since 2013, a team from EPFL has been working on a technology that remotely synchronizes autonomous vehicles. BestMile is the first software platform to optimize real-time monitoring of public transportation based on a predetermined or on-demand schedule.

Tesla and Google have developed hardware for autonomous private vehicles but no existing company has dealt with the question of public transportation before. BestMile is currently running some tests in Cossonay, where their software controls a driverless bus that shares the road with normal cars – another milestone in robotics for the region:

The canton of Vaud fosters the development of mobile robotics in other economic sectors too. Agriculture, for instance, could soon benefit from the region’s strong innovation culture.

ecoRobotix, a startup based in Yverdon-les-Bains, plans to commercialize the first completely autonomous weed puller powered through solar energy in 2018. Equipped with sprayers, sensors, GPS and a camera, the robot adapts its pace to the concentration of weed. Only a microdose of herbicide is applied, since the robot specifically targets the weeds it detects through artificial vision. Remotely controlled using a smartphone or tablet, the machine should be able to cover as much as three hectares per day.

The lack of administrative barriers characteristic of the region is often listed as a central component of its innovation success. SeaBubble, a French startup working on an aquatic vehicle that could potentially solve the problem of traffic jams in big cities, recently decided to open a branch in the Lake Geneva area where it has already started conducting tests. It is also in discussion with Google with a view to rendering their vehicle completely autonomous.

INDUSTRIAL ROBOTS PERFECTING THE TRADITION OF WATCHMAKING

“Western Switzerland has always been at the forefront of innovation in robotics. The region’s important watch-making industry is responsible for its expertise in micro-engineering, from which robotics is derived,” explains Hannes Bleuler, Professor at EPFL and Director of the Robotic Systems Laboratory (LSRO).

EPFL’s sister school, Eidgenössische Technische Hochschule Zürich (ETHZ), opened its micro-engineering institute in 1968, a year before EPFL. However, in Lausanne, a small team started working on robotics in 1973 – whereas Zurich’s first robotics laboratory only opened in 1990.

Sources: Deloitte, Statista
Sources: StartupTicker, International Federation of Robotics

100 million
the amount already raised by Rewired, a venture studio and investment fund based in Lausanne and London that was launched this year (USD). Rewired aims to encourage innovation in machine perception, in the hope of unlocking the next generation of smart robotics.
WHEN ROBOTS AND HUMANS WORK TOGETHER

NCCR Robotics: leader in human-oriented robotics

The presence of the National Center of Competence in Research (NCCR) Robotics is a valuable Swiss asset. Funded by the Swiss National Science Foundation (SNSF), EPFL and ETHZ, NCCR Robotics is the only federal research consortium in its field in Switzerland.

The association promotes human-oriented robotics, gathering approximately 100 researchers from 23 labs, all devoted to improving quality of life through the development of intelligent robots. These experts are recruited from EPFL, ETHZ, the University of Zurich, the University of Bern and the Instituto Dalle Molle di Studi sull’Intelligenza Artificiale (IDSIA) in Lugano.

Since 2014, the consortium has funded 10 spin-offs, including six in the canton of Vaud. These projects have raised over 16 million CHF in venture capital and are also responsible for the creation of 90 jobs across the country.

“NCCR Robotics does not directly fund research and development projects in the field of industrial robotics. The consortium never intended to solely promote state-of-the-art technology; we focus primarily on disruptive innovation by supporting R&D in emerging areas of robotics. We aim to develop solutions that could serve future individual and societal needs. Our intelligent robots are developed to protect, assist and restore humans to health”, says Jan Kerschgens, Managing Director and knowledge and technology transfer officer for the consortium.

The educational robot Thymio perfectly illustrates this mindset. Supported by NCCR Robotics since 2012, this technology is now used in more than 10,000 schools across Europe. Thymio is a small and programmable robot that allows teaching the basics of coding to children of all ages. Cellulo is another exciting educational tool from NCCR. According to Jan Kerschgens, “Cellulo, which is not yet commercialized, has the potential to become another successful educational tool developed by our consortium. As its name indicates, Cellulo works on paper, which is the most abundant material in classrooms. It consists of a palm-sized robot that can interact with the learner individually or in swarms, with other robots. The robots work out their location on a piece of paper based on the scenario teachers decide to implement.”

While the consortium puts emphasis on developing new areas of robotics, it also values technology transfer to industry. NCCR Robotics annually organizes a conference – the Swiss Robotics Industry Day – at EPFL’s SwissTech Convention Center, in order to present its projects to industry and discuss potential avenues for collaboration.
FROM LOGITECH TO VIRTUAL REALITY: THE FLOURISHING OF COMPLEMENTARY TECHNOLOGIES

Reaping the benefits of interdisciplinary work between first-class institutions.

The canton of Vaud’s strong innovation culture pervades technologies that are complementary to robotics. Logitech – also known as Logi – the world’s largest producer of computer mice, is probably the best-known example in the history of the canton. In 1981, Daniel Borel and Giacomo Marini co-founded the company in the village of Apples, near Morges. They worked closely with Professor Jean-Daniel Nicoud from EPFL, who developed the first prototype of the famous mouse. “Professor Nicoud, a specialist in micro-informatics, was simply visionary. He is an important figure in the top-notch development of complementary technologies in Western Switzerland”, recalls EPFL professor Hannes Bleuler.

In 2013, Logi moved its headquarters to EPFL. Since 2005, half of its production takes place in Suzhou, China. In 2008, the firm sold its billionth mouse, but the business is now highly diversified and includes speakers, webcams, voice headsets, keyboards and more.

Interdisciplinary work plays an important part in the exceptional flourishing of complementary technologies in the canton of Vaud. The proximity to eminent institutions from other cantons, such as the University of Geneva (UNIGE) and its hospital (HUG), generalizes this phenomenon beyond the canton’s borders.

Indeed, a joint project between EPFL’s Brain Mind Institute and the Department of Neurology of HUG aims to apply virtual reality to cognitive sciences. Led by Professor Olaf Blanke, this collaboration could notably cast light on brain mechanisms, such as self-consciousness, and improve rehabilitation strategies and exoskeletons.

Virtual reality is another sector that has received support from NCCR Robotics. The consortium started funding Foldaway Haptics this year, a project that develops innovative haptic interfaces. These unique sensors can track the motion of fingers and provide texture, stiffness and force perception for the user. “Feeling” virtual reality is one major application.

“Technology transfer to industries usually takes at least five years. At NCCR Robotics, we believe that cobots – robots co-working with humans – are very likely to be the future of companies.”
In the canton of Vaud, progress in robotics has been further expedited by the region’s open-mindedness. Companies in western Switzerland easily build partnerships with the industry across the country and internationally. In particular, technologies that are integrated within robots have been blossoming thanks to this tradition. Important advances in haptic feedback and AI, for example, demonstrate how the canton of Vaud has become an expert in all the major sub-fields of robotics.

Based in Nyon since 2001, Force Dimension is specialized in haptic devices, which have been applied to several industries. In 2007, the company collaborated with the non-profit research institute SRI International, with NASA and surgeons from the University of Cincinatti to test the capabilities of its haptic interface during robotic surgery performed in space. This experiment proved the precision of Force Dimension’s technology even in extreme environments. In a joint project with the US firm Hansen Medical, Force Dimension also applied its device to robotic catheter systems in a standard operating theatre. Haptic guidance has the positive effect of increasing the accuracy of surgical robotics, notably by limiting unwanted tool behaviour.

THREE QUESTIONS TO PROFESSOR DARIO FLOREANO, DIRECTOR OF NCCR ROBOTICS

How would you summarize NCCR Robotics’ main goal in a few words?
We aim to improve outreach, technology transfer and education concerning future intelligent robots that are meant to work with and assist humans. Our research is dedicated to three areas of robotics. We work on wearable technology such as prosthetics and rehabilitation devices. We are also committed to optimising search and rescue missions. Our robots are specifically designed to deal with the challenging environment of territory inspection and transportation of civilians. Finally, we are trying to educate the next generation in general, not just engineers, on computational thinking. We develop innovative solutions to get children familiarized with machines and coding.

How helpful is the canton in regard to promoting innovation?
I can think of at least two key factors that explain why the canton of Vaud is a vibrant hub for innovation. On one hand, EPFL is an incredible ecosystem that concentrates many leaders from the scientific community. Indeed, its reputation attracts some of the best talents in the world. On the other hand, the canton has a proactive attitude towards innovation. Its public institutions sustain a dynamic environment for technology transfer. There is a broad network of federal and local agencies that strongly encourages the creation of spin-offs.

Can you tell us a bit more about Twiice, NCCR Robotics’ unique project to help the disabled walk again?
A strong team has been devoted to making the technology used in Twiice possible. Neuroscientists from the local hospital Lausanne University Hospital (CHUV) have been collaborating with Professor Hannes Bleuler and his team to develop this exoskeleton. Their mechanical devices could help people suffering from partial or full paralysis to stand. The results are promising so far. Twiice scored really well in the Cybathlon – an international competition launched by ETHZ, in which disabled competitors are assisted with bionic technology. Many other research groups are committed to this cause, but only a few have been able to come up with an efficient wearable solution like Twiice’s."
# MAIN ACTORS OF THE ROBOTICS ECOSYSTEM

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**Industry**

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- Bosch Packaging Technology
- Del West
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- Novigenix
- Program
- René de Siebenthal & Fils
- ROVENSO
- Safran Colibrys
- TCI Engineering
- Valtronic Technologies
RESEARCH AND DEVELOPMENT

Biorobotics Laboratory (BIOROB)
The BIOROB focuses its research on the computation of sensorimotor coordination, locomotion control, and animal as well as robot learning.
ncr-robotics.ch/nccr-labs/biorobotics-laboratory-biorob

Chair in Spinal Cord Repair (IRP)
The EPFL’s Chair in Spinal Cord Repair (IRP) works on reversing motor dysfunctions due to central nervous system disorders, especially spinal cord injury. IRP also aspires to translate their findings into clinical applications, in order to improve the quality of life for people with motor impairments.
ncr-robotics.ch/nccr-labs/chair-in-spinal-cord-repair-irp

Computer-Human Interaction in Learning and Instruction (CHILI)
Formerly known as CRAFT, the Computer-Human Interaction in Learning and Instruction (CHILI) lab carries out research into novel interfaces for learning, with a special emphasis on team learning.
ncr-robotics.ch/nccr-labs/computer-human-interaction-in-learning-and-instruction-chili

Defitech Foundation Chair in Brain-Machine Interface (CNBI)
Part of the EPFL Center for Neuroprosthetics and Institute of Bioengineering, the Chair in Brain-Machine Interface (CNBI) investigates the use of brain signals to control devices and help humans manage their environment better.
ncr-robotics.ch/nccr-labs/chair-in-brain-machine-interface-cnbi

Embedded Systems Laboratory (ESL)
The ESL is part of the Institute of Electrical Engineering at EPFL. It carries out research on system-level multi-objective design methods, nanoscale Multi-Processor System-on-Chip (MPSoc) architectures, optimisation methodologies and tools for high-performance embedded systems.
ncr-robotics.ch/nccr-labs/embedded-systems-laboratory-esl

HEIG-VD Robotics Club (CRH)
The HEIG-VD Robotics Club gathers students who are passionate about robotics on a voluntary basis. The club takes part in the Eurobot competition, in which students are required to build a fully autonomous robot.
heig-vd.ch/campus/vie-sur-le-campus/associations/crh

Institute of Industrial Automation (iAi)
The Institute of Industrial Automation (iAi) covers many aspects of robotics, such as virtual reality, manufacturing standards, industrial and collaborative robotics, to name a few.
iai-dev.heig-vd.ch/presentation/groupe-automatisation-industrielle

Laboratory of Cognitive Neuroscience (LNCO)
The LNCO and its Bertarelli Chair in Cognitive Neuroprosthetics aim to cast light on brain mechanisms such as self-consciousness, body perception and body awareness.
ncr-robotics.ch/nccr-labs/laboratory-of-cognitive-neuroscience-lnco

Laboratory of Intelligent Systems (LIS)
The LIS combines engineering with biology. It designs future robotics systems, in the hope of understanding biological systems better.
ncr-robotics.ch/nccr-labs/laboratory-of-intelligent-systems-lis

Laboratory for Soft Bioelectronic Interfaces (LSBI)
The LSBI lies at the crossroads between engineering and biology. Its multidisciplinary team works on the integration of soft bioelectronic interfaces – also known as “electronic skins”. The lab specializes in stretchable materials and devices, which are implemented into ultra-compliant, conformable circuitry and soft biointerfaces.
ncr-robotics.ch/nccr-labs/laboratory-for-soft-bioelectronic-interfaces-lsbi
Learning Algorithms and Systems Laboratory (LASA)
The LASA is committed to developing means by which robots can learn how to perform tasks with the same level of dexterity as humans.
ncr-robotics.ch/nccr-labs/learning-algorithms-and-systems-laboratory-lasa

Reconfigurable Robotics Laboratory (RRL)
Researchers at the Reconfigurable Robotics Lab (RRL) design and build unique robotic systems. The team is committed to developing interactive robotic systems with novel fabrication techniques and integration processes, while trying to push the boundaries of mechanical properties.
ncr-robotics.ch/nccr-labs/reconfigurable-robotics-laboratory-rrl

Robotic Systems Laboratory (LSRO)
The LSRO is a multidisciplinary research unit dedicated to high-precision instrumentation and robotics, including micro-robotics.
lsro.epfl.ch

Robopoly
Entirely run by students, Robopoly is EPFL’s only maker-space. It was created to promote robotics and the maker culture.
robopoly.epfl.ch

Translational Neural Engineering Laboratory (TNE)
The TNE develops effective neurotechnologies aimed at restoring sensorimotor functions of the physically disabled.
nccr-robotics.ch/nccr-labs/translational-neural-engineering-laboratory-tne
ESTABLISHED BUSINESSES AND STARTUPS

ABB
ABB invented the IRB 6 in 1974, the first microprocessor-controlled robot ever commercialized. Most of today’s industrial robotics is based on this invention. Robots are now found in every industry, from logistics to automobile manufacturing, due to great advances in automation. Machine learning has recently become a new robotics niche.

ABB

BlueBotics
BlueBotics is primarily active on the navigation market. Its unique Autonomous Navigation Technology (ANT) solution for autonomous vehicles could also be applied to service robotics and light load logistics.

BlueBotics

Bollhoff Attexor
Manufacturing company Bollhoff Attexor is a leader in the field of clinching, a technology that fastens sheet metal without fasteners.

Bollhoff Attexor

Bosch Packaging Technology
With its subsidiary Sapal, the German company Bosch Packaging Technology has set up part of its activities on the Y-PARC site in Yverdon-les-Bains. The company specialises in robotic packaging modules, particularly for the food industry.

Bosch Packaging Technology

Décision
Décision takes advantage of the exceptional properties of composite materials to produce innovative structures.

Décision

Del West
Del West welds engineering precision to exotic materials. The company develops unique products for several industries, such as titanium valves for engines, aluminium components for watches, essential parts of medical devices or building blocks of aerospace fleet.

Del West

ecoRobotix
ecoRobotix invented the first ever fully autonomous weeder. The startup developed a solution for weeding meadows, row crops and intercropping cultures that is economically and ecologically efficient.

ecoRobotix

Festo
Festo offers its automation know-how to various sectors, including the packaging, automobile, chemical and medical industries.

Festo

Fischer Connectors
Fischer Connectors produces cable assemblies and push-pull circular connectors of a very high standard.

Fischer Connectors

FiveCo
FiveCo is active in the field of image processing. The company creates innovative microcontroller systems with complex mechanics and embodied intelligence.

FiveCo

Force Dimension
Force Dimension is internationally recognized for its high-precision haptic interfaces, which are integrated within medical and industrial robotic systems.

Force Dimension

IKRtech
IKRtech has been dedicated to expanding the field of electromechanics for more than a decade. Its multidisciplinary team creates novel motors that are perfectly suited to their clients’ needs.

IKRtech
Imina Technologies
Imina Technologies make robots that enhance the performance of light and electron microscopy.
imina.ch

K-Team
K-Team works on high-quality mobile robots for advanced education and research. Three of its devices – Koala, Kilobot and Khepera – are already widely used in the academic world.
k-team.com

Lemo
Lemo develops high-quality push-pull connectors with a wide variety of applications to challenging environments.
lemo.com

Mobsya
The non-profit association Mobsya supports efforts to advance science and technology that is respectful of humans and their environment. Mobsya is, for example, in charge of producing the educational robot Thymio.
mobsya.org

North Thin Ply Technology (NTPT)
North Thin Ply Technology (NTPT) has revolutionized the world of laminate composites. The company develops new materials with significantly improved mechanical properties. As a result, NTPT’s microfibers can be optimally positioned for their intended use.
thinplytechnology.com

Novigenix
Screening and diagnostic tools for the early detection of cancer.
novigenix.com

Program
Founded in 1997 at EPFL, Program specializes in coding and machining of mechanical components. The company is well-known for its exceptional mastery of the 5-axis milling technique.
programsa.ch

René de Siebenthal & Fils
René de Siebenthal & Fils specializes in machining of materials by chip removal. The company is notably equipped with 5-axis milling machines that can machine parts of up to 1,100 mm in length.
desiebenthal.ch

Rovenso
Rovenso works on developing robots that can perform dangerous tasks in complex environments such as hurricanes, earthquakes, explosions, landslides or fires. Manipulating heavy material in extreme conditions often proves to be very dangerous for humans. Current automated systems usually struggle to handle these challenging situations too.
rovenso.com

Safran Colibrys
Safran Colibrys specializes in the manufacturing of high-precision micro-electro-mechanical systems (MEMS) for aerospace applications.
colibrys.com

TCI Engineering
TCI Engineering provides personalized solutions for industrial automation. The firm contributed to the development of over 1,200 high-tech systems.
tci-sa.ch

Valtronic Technologies
Valtronic develops innovative solutions for the medical world. It collaborates with manufacturers of medical devices around the world, in order to help them achieve their goals, boost their competitiveness and ultimately, improve the quality of life.
valtronic.com
NETWORK OF SUPPORTING PARTNERS

Economic Development – Canton of Vaud (DEV)
The DEV is the main contact for foreign companies looking to set up in the region. To fulfill its role, the DEV works with both private (banks, notaries, lawyers, etc.) and public partners (various government departments).
dev.ch

Innovaud
As a gateway to innovation in the canton of Vaud, Innovaud supports and provides networking opportunities for start-ups and SMEs, particularly those in life sciences, to develop solutions with them in the area of hosting, promotion, funding and/or coaching.
innovaud.ch

Micronarc
The Micronarc communication platform brings together all the cantons of Western Switzerland. Its aim is to develop and promote the micro- and nanotechnology cluster common to this region, from a scientific, technical and economic point of view. It thus highlights the infrastructures for training, R&D, technology transfer and hosting, as well as the companies located there.
micronarc.ch

NCCR Robotics
The National Center of Competence in Research (NCCR) Robotics is a federal consortium funded by the Swiss National Science Foundation (SNSF), which brings together some of the best researchers in the country. The organisation is committed to improving the quality of life for the Swiss population by showing its support to new human-oriented technologies.
nccr-robotics.ch

Robot-CH
Robot-CH is the umbrella organisation for robotics in Switzerland. It gathers the main associations of the field, along with research institutes, public entities and a large number of engineers.
robot-ch.org

TecOrbe
Located in the north of the canton of Vaud, the Technopôle de l’Environnement d’Orbe has over 7,000 m² of office space, laboratories and industrial facilities adapted to the needs of SMEs in cleantech: the environment, sustainable development, renewable energies, improved manufacturing processes. It also has a startup incubator devoted to the creation of businesses and to supporting them in their initial stages of growth. Financially supported by the Canton, TecOrbe has a particular focus on questions of energy efficiency.
tecorbe.ch

Office for Economic Affairs and Innovation (SPEI)
The SPEI supports companies established in the canton of Vaud, and more specifically those active in the sectors of industry and advanced technologies. SPEI advises and informs entrepreneurs, particularly by putting them in touch with the appropriate organizations according to their specific needs. SPEI can also provide direct financial support.
invest-vaud.swiss