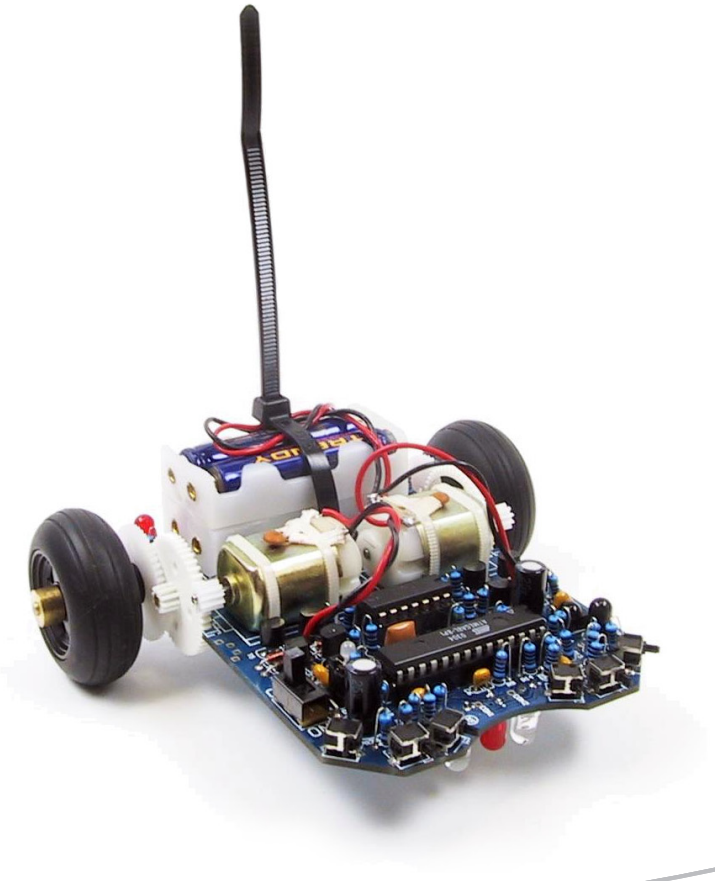
DLR



DLR_School_Lab

Oberpfaffenhofen

Robotics

ASURO
Another Small and Unique Robot from Oberpfaffenhofen

Will robots replace people anytime soon?

The term "robot" is derived from the Czech word for work, "robota."

Robots are used today for a wide variety of purposes. The range extends from industrial robots, which have no interest in wage negotiations or nighttime bonuses, to small researchers on Mars to medical instruments that can be used to save lives.

At present there are already 148 robots for every 10,000 employees in German industry, with more coming. But there is quite a way to go before our situation resembles that in the movie "I, Robot"...

Robotics

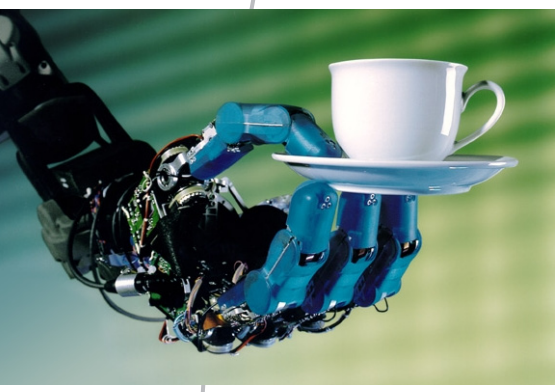


Fig. 1: Robots are used in many fields

Robotics

Robotics is a DLR topic in many different fields. Besides applications useful in business and industry, the focus is also on basic research about "what is possible today," and of course on aerospace research. Scientists from a variety of disciplines like electrical and mechanical engineering, computer science, physics and medicine work together to set new benchmarks in robotics.

Medicine
Robots have become essential tools in the medical sphere. The results of innovative research, for example minimal invasive surgery, help surgeons to do their work and reduce patient recovery time.

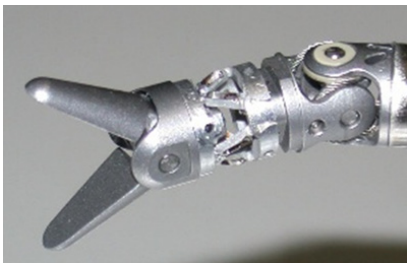


Fig. 2: Tiny gripper for surgical operations

ROKVISS
On March 22, 2005 at 13.30 Uhr MEZ a new chapter began for German space robotics with the first movements of a German robot in free space. The innovative robotics experiment ROKVISS (RObotik-Komponenten-Verifikation auf der ISS – Robotik Component Verification on the ISS), a technology demonstrator of various new procedures, is a DLR creation which can operate in an automatic mode as well as in a so-called telepresence mode. In the latter mode this two-jointed robot arm can be controlled from Earth with the aid of a joystick and stereo camera. The measured forces can be directly sensed and felt at the joystick used by the operator. Instead of functioning for the expected one to two years, ROKVISS is still operating after more than four years.

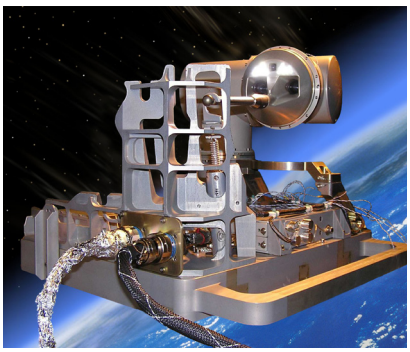


Fig. 3: ROKVISS – high-tech in space

The Experiment

The DLR_School_Lab "Robotics" experiment begins with a construction kit containing over 130 parts. At the end, if they are all soldered together properly, a robot named "ASURO" emerges which can independently follow a line. In between are four hours of highly concentrated soldering, lots of creative programming, and technically skilled mechanical work. For these reasons the experiment is ideal for the high school grades or for particularly clever junior high school students.

ASURO was developed at the DLR Institute of Robotics and Mechatronics for DLR_School_Lab Oberpfaffenhofen. It can be assembled by the students and then programmed in C. In addition to light-emitting diodes as display instruments, ASURO has six probes and two photodiodes which it uses to investigate its environment. Its two motors can be separately controlled and their revolutions (rpm) can be determined with reflective light barriers. Depending on

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interest and ability, ASURO can be augmented with various additions: besides ultrasonic sounding (the same principle used by bats), heat source locating and optical triangulation navigation, there is a LC display and a metal detector.

ASURO is distributed under DLR license by various electronics suppliers. The assembly kit is very popular, particularly in schools, but also with other electronics enthusiasts. Besides communicating technical skills, electrotechnical knowledge and basic programming awareness, this experiment is also fun to do and a way to enjoy modern science and technology.

News and prospects

A new experiment is being developed in which ASUROnaut, like a Rover mission on the moon or Mars, will investigate an unknown, invisible landscape. ASUROnaut is an exploration robot based on ASURO technology but with more sensors. The user can navigate using telepresence radio control with the help of a joystick, head-mounted display (HMD) and radio-stereo camera.

How ASURO functions is clearly explained in, "More fun with ASURO." The book also has many tips as well as information about how to construct auxiliary circuit boards. See http://wwwfef.arexx.com/forum/viewtopic.php?f=9&t=232 for publication information and http://www.arexx.com/arexx.php?cmd=goto&cparam=p_asuro for details about available hardware accessories.

Fig. 4: Putting ASURO together calls for concentration and precision

Fig. 5: ASUROnaut

Glossary

Minimal invasive surgery
Conducting classic, traditional medical operations but through very small entry points. In the case of abdominal operations, for example, this avoids having to make a large abdominal incision. Actually, a more precise designation would be "minimal access surgery."

ROKVISS
"RObotik-Komponenten-Verifikation auf der ISS" is a robot arm about 50 cm long with two joints, a metal finger and two integrated cameras. It is used on the International Space Station ISS to carry out various types of experiments.

C
A programming language developed by Ken Thompson in the early 1970s and forming the basis of many operating systems.

Photodiode
Electronic semiconductor component used to measure light intensity. It functions because of the photo effect, first described by Albert Einstein, which gained him a Nobel Prize in 1921.

List of Figures

DLR at a Glance

DLR is Germany's national aeronautics and space research center. Its extensive research and development activities in the fields of aeronautics, space, transportation and energy are integrated in national and international cooperative ventures. In addition to this research, as Germany's space agency the federal government has given DLR the responsibility to plan and implement the German space program and to represent German interests internationally. DLR is also the umbrella organization for Germany's largest project management agencies.

Approximately 6,500 people are employed at DLR's 13 locations, which include Köln (headquarters), Berlin, Bonn, Braunschweig, Bremen, Göttingen, Hamburg, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stuttgart, Trauen and Weilheim. DLR also operates offices in Brussels, Paris and Washington D.C.

DLR Oberpfaffenhofen

Aerospace, environment and transportation are DLR's primary fields of interest in Oberpfaffenhofen. Some 1,500 people work there in nine different institutes and facilities, making DLR Oberpfaffenhofen the largest DLR location.

DLR **Deutsches Zentrum für Luft- und Raumfahrt** e.V.
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