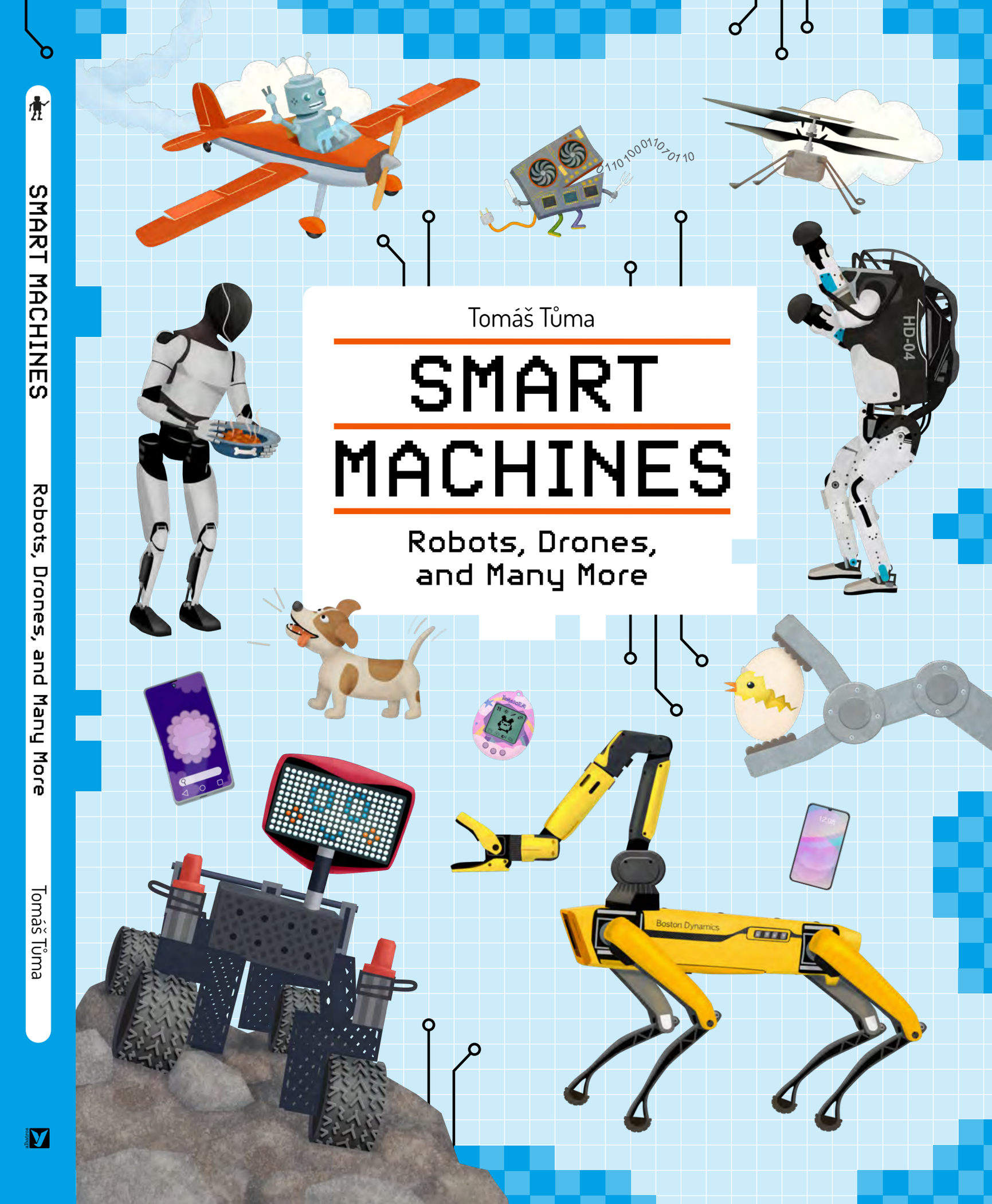


SMART MACHINES
Robots, Drones, and Many More
Tomáš Tůma

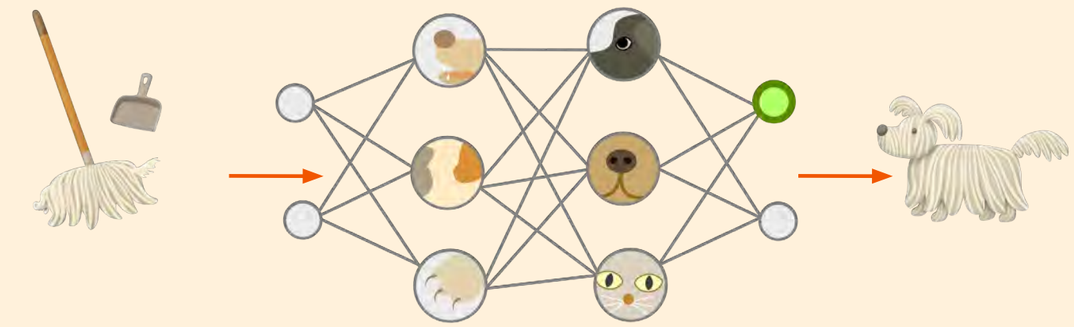
ARTIFICIAL INTELLIGENCE

Most modern machines would not work if they followed only a program written line by line. Their intelligence is based on a trick we humans use too: learning.

How a Machine Learns

Telling a dog from a mop used to be hard for computers, but today machines can learn in ways similar to our brains. Information in our heads is processed by tiny cells called neurons, linked in many ways. Scientists copied this idea into computers, allowing machines to learn to think.

Fluffy body, tail, and ears, 99 percent chance it is a dog! No, mistake. It is a mop!



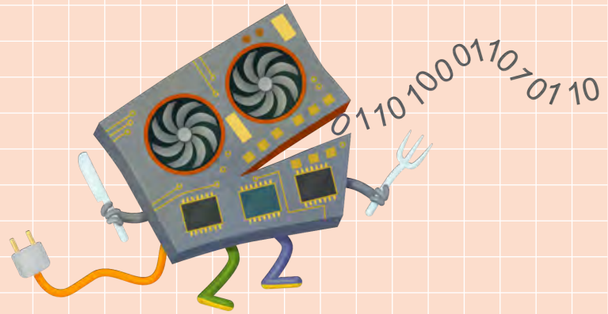
Neural Network

Science Breakthrough

Its scientific use has proved how valuable AI is. A neural network called AlphaFold learned how to predict the shape of proteins, tiny building blocks inside living cells. Research like this, which is important for developing new medicines, used to take years. Nowadays, the result is ready in no time.

Hungry for Data!

Machine learning has a huge appetite for data. Artificial intelligence often learns from information available across much of the internet. Training takes place on special computers similar to powerful graphics cards used in gaming PCs.

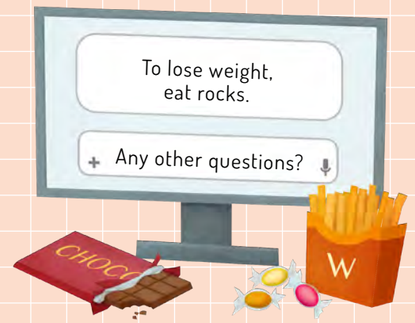


Hallucinations!

One of the well-known weaknesses of chatbots and large language models (LLMs) is something called hallucinations. Sometimes artificial intelligence tries a bit too hard to give an answer, and it starts making things up. So trust, but verify!

Checkmate!

Back in 1997, the computer Deep Blue defeated world chess champion Garry Kasparov. With the rise of artificial intelligence, computers went on to win games once thought impossible for machines to learn, such as Go, especially popular in China and Japan.

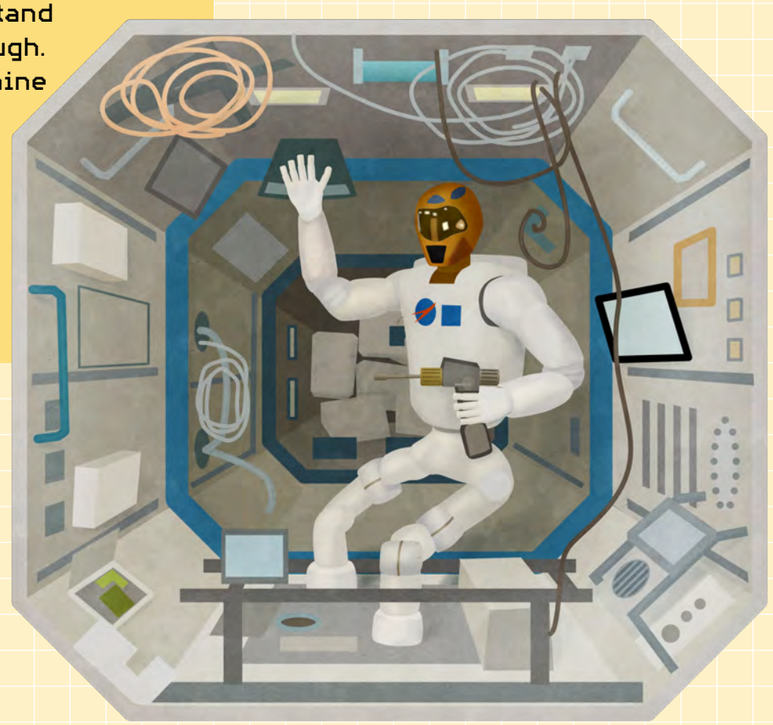


The Turing Test

This test was designed to find out whether and how much a computer is intelligent. If a tester cannot tell which answer was written by a computer or a human, it is considered proof of intelligence. Today we know this is a simplified view — human intelligence involves not only knowledge but also creativity and understanding emotions.

HUMANOID ROBOTS II

Universal humanoid robots could one day replace humans in many kinds of jobs, once they learn to understand the world around them well enough. It seems that advances in machine learning may reach this goal surprisingly soon. In fact, the first androids, such as Figure 02, are already being tested.

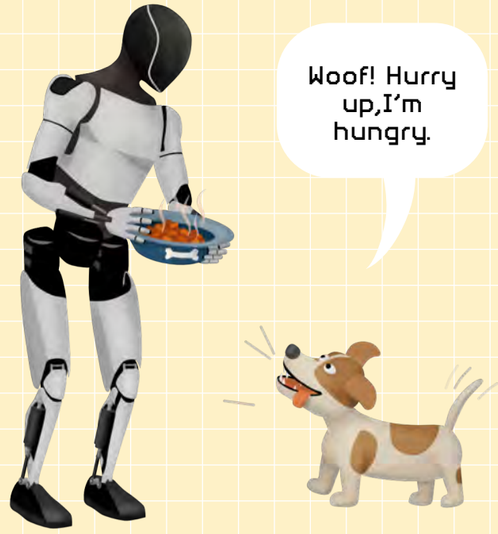


Robonaut

Humanoid robots have already made it into space. Robonaut was designed as a versatile helper that can assist with tasks like repairing a space station. It even has special climbing legs made for weightless conditions. And when people need it to travel across the surface of a planet instead, its legs can simply be swapped for a wheeled base.

Asimo

This robot, created by the company Honda, amazed audiences when it was first introduced with its smooth movements, ability to walk up stairs, and even hop on one leg. Its software already included face recognition and voice commands, and thanks to its sensors it could move around completely on its own.

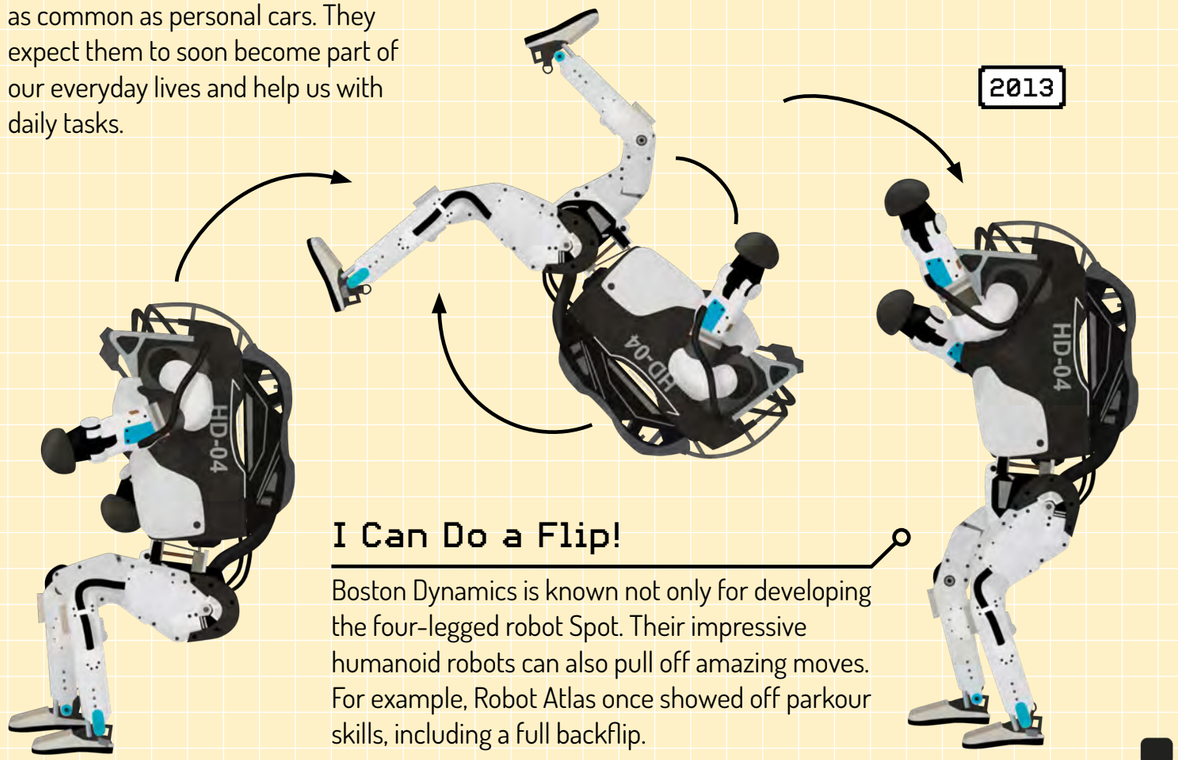


Optimus

The company Tesla, which is developing the robot Optimus, believes that mass production will make robots like this as common as personal cars. They expect them to soon become part of our everyday lives and help us with daily tasks.

Digital Playground

Robots are also trained in virtual environments that perfectly simulate the laws of physics. What would take hundreds of hours in the real world and leave an operator with a sore back from constantly picking the robot up off the ground can be done in just a few minutes.

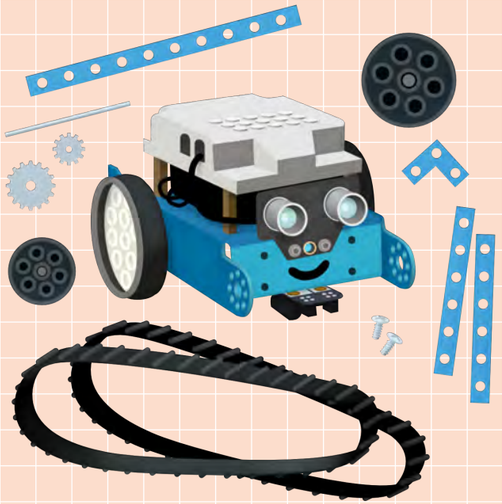


I Can Do a Flip!

Boston Dynamics is known not only for developing the four-legged robot Spot. Their impressive humanoid robots can also pull off amazing moves. For example, Robot Atlas once showed off parkour skills, including a full backflip.

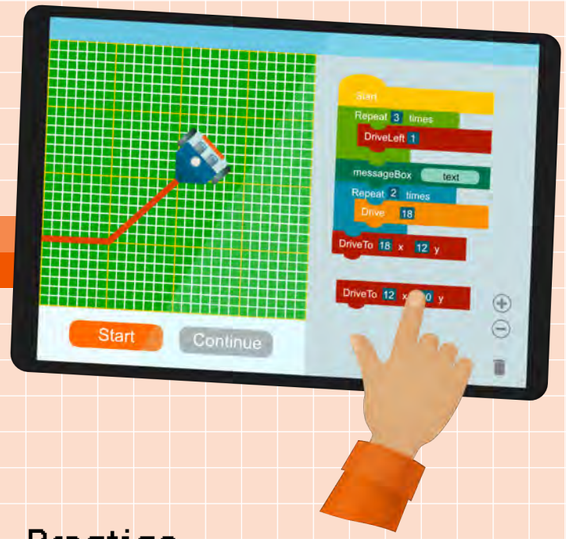
BUILD YOUR OWN ROBOT

Would you like to build a robot all by yourself? No problem. There are many different robot kits you can buy and use to create all kinds of clever machines. Let's take a look at a few of them!



Building Kits

There is a wide range of building kits available. Some include simple, easy-to-assemble vehicles with sensors that can be programmed using an app on a tablet or smartphone. Others are more advanced and expensive sets designed especially for schools.



Practice Programming

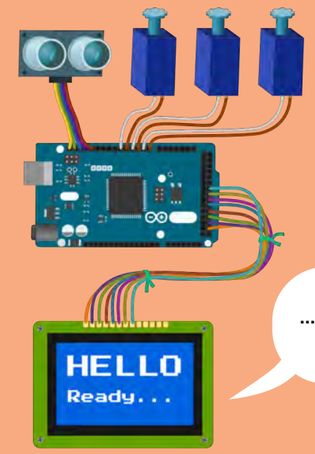
Before you start testing a real robot, you can try programming it using an app or a web browser.

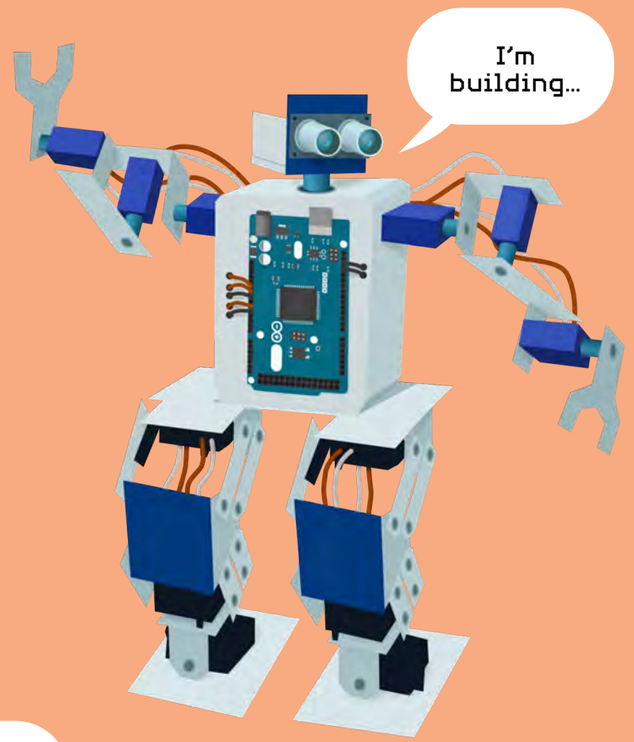
Toys

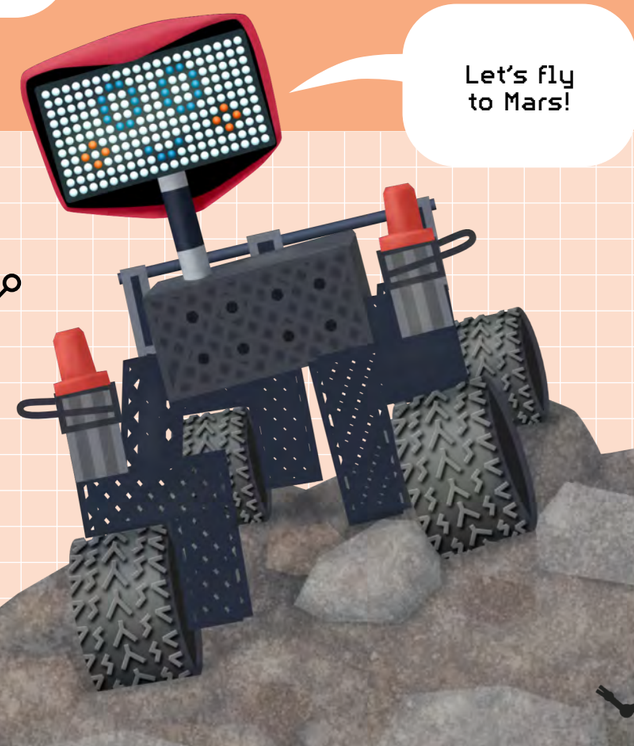
Do you enjoy programming but do not feel like building a robot from scratch? Then there are countless programmable toys you can control with a remote, an app, or buttons built right into the toy itself.

Arduino

For advanced builders, there are open platforms that can be connected to countless devices and programmed to fit your own ideas. One of the most popular platforms is Arduino. You can equip an Arduino board with a chassis, add sensors, a GPS module, or almost anything else you can imagine.







Raspberry Pi

A Raspberry Pi is a tiny computer about the size of a credit card, but it is powerful enough to replace a desktop computer or control a robot. Interesting open-source projects you can build with a Raspberry Pi even include plans for a simple Mars rover developed by NASA.

ROBOT COMPETITIONS

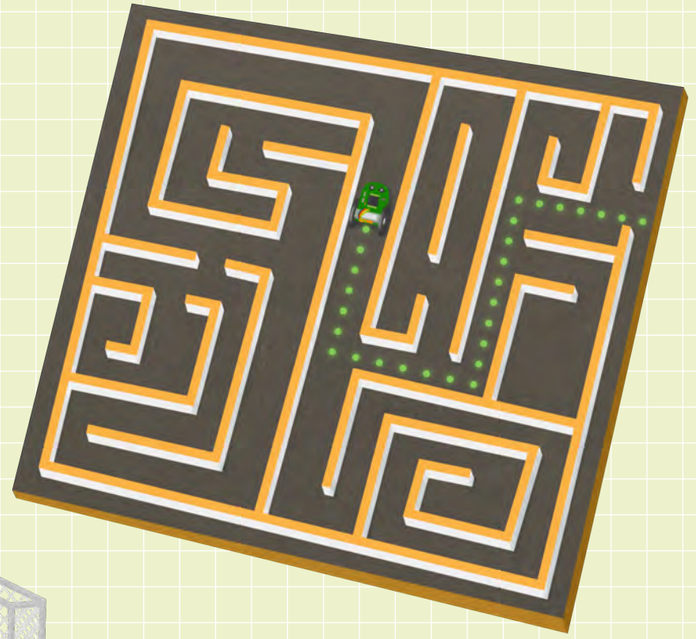
Machines can be fun too, that's for sure. Robots can compete in sports leagues, solve tricky challenges, or even battle each other like gladiators. Sounds unbelievable? Then keep reading!

RoboCup

RoboCup is an international competition held every year, where robots face off in soccer matches. It was founded back in 1996, and its ambitious goal is that by the year 2050, a team of robots will be able to defeat a team made up of the world's best human soccer players. What do you think, will they make it?

Against the Ropes

This is where things get rough. In competitions like the TV show BattleBots, machines are trying to tear each other apart!

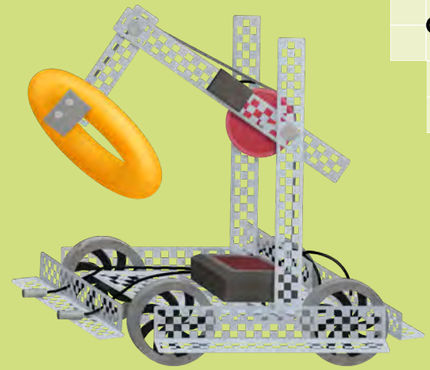


Maze Runners

Competitions for smaller robots, such as Micromouse, where the goal is to find the fastest way through a maze, are great training grounds for autonomous control and decision-making.

VEX Robotics

One of the largest robot competitions in the world is the VEX Robotics Competition, where teams of student builders from across the globe come together. Competitors take on challenges like placing plastic rings onto poles.



SMART HOME

Home automation actually began long ago, with the introduction of running water or central heating. But progress is speeding up fast. One day, the future might look like this: smart home sensors decide in the morning whether you feel like having pancakes, and the control system sends a robot to the stove.

Saving energy!

Home Security

Monitoring by security cameras and other sensors does more than protect property from thieves or fires. Advanced technologies can even detect medical emergencies in the home and call for help.

The Brain of the Home

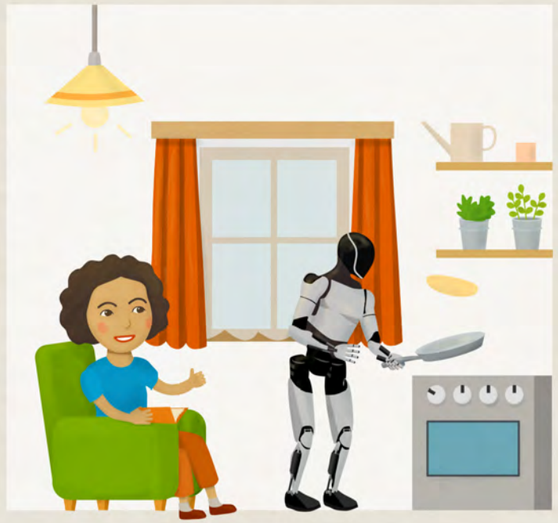
Individual devices can be controlled on their own, but for a smart home, it is more efficient to use a central computer. It can better coordinate how all the devices work and cooperate with one another.

Mirror, Help Me Out

A talking mirror used to exist only in fairy tales, but today it is real. It adds information like the weather or the latest news to your reflection using a hidden display, while its camera can even analyze the condition of your skin.

Connected Homes

Sharing information between homes is useful for managing energy. A smart grid can offer electricity from rooftop solar panels to neighbors who need it at the moment or have a place to store it.



Smart Toilet

A smart toilet does more than save water. It can turn on the lights, warm the seat, or play music through speakers to create the most comfortable atmosphere possible. No wonder it is hard to get up afterward.

Saving Energy

One of the most useful parts of a smart home is the thermostat. It can track the habits of the people living in the house and adjust the heating temperature accordingly. When used properly, it can save a lot of money.

They Hacked My Fridge!

Perfectly connected devices also mean an opportunity for troublemakers. A hacker could use your smart refrigerator to place an online order without you knowing!

VIRTUAL REALITY

A virtual walk through ancient Rome helps us imagine ancient civilizations much faster than reading a long text. A medical student can practice an operation without risking a human life, and an architect can guide clients through the design of a new home. The use of virtual reality is certainly not limited to action games.

Virtual Tour

With VR goggles, you can step into a tour of a real-world model, either filmed with a special camera or created in 3D software. To create the feeling of free movement, for example across a distant planet's surface, an omnidirectional treadmill can be used.

I'm Flying

Professional simulators, such as those for airplane pilots or Formula 1 drivers, add the sensation of motion and g-forces to the simulation. Tilting in the desired direction is handled by a hydraulic system or powerful electric motors.

Experimental Add-ons

The more senses are involved in perception, the more convincing the virtual experience feels. Even a regular fan can help. Devices are also being developed to regulate temperature, add scents, or even simulate taste using electrical stimulation of the tongue.

Digital Goods

In an open virtual world, you can build landscapes, form relationships, or buy goods using virtual or real currency. The price tags on some digital items can be surprising. For example, a Gucci handbag sold in the game Roblox for 4,000 dollars!

Accessories

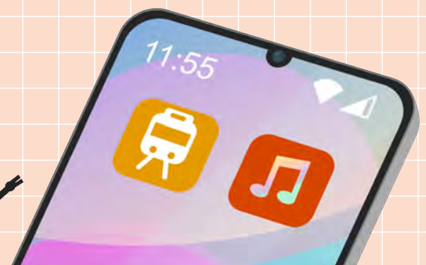
When playing games, a player's movement also needs to be tracked. For this, hand controllers are used to record the movement of the hand, allowing you to hold things like a virtual sword. Haptic gloves then create the illusion of touch or impact.

VENDING MACHINE

The first vending machines that sold goods worked without any complex electronics. Their modern successors, however, can communicate with a phone, notify the seller when supplies need refilling, and display product details on a touchscreen.

A Vending Machine in Your Phone

Some vending machines no longer need to exist physically. For example, tickets can be purchased with a single tap on your phone. Even once-common jukeboxes are disappearing, because all the music is now available through streaming services, anywhere and for everyone.



No Staff Needed

Staff costs make up a significant part of a store's expenses. When a vending machine replaces a salesperson, goods can be sold more cheaply and around the clock. Without supervision, though, the machine must be secure and reliable.

Poetry Machine

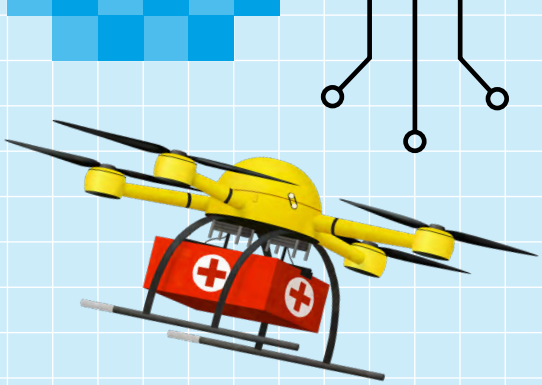
A vending machine can be made for almost anything, just for fun or as an artistic project. One example is a poetry machine that plays poems on request to people passing by in a park. Do you have an idea for a fun vending machine?

Robotic Farm

Robots are learning to harvest agricultural crops. Large machines can pick apples in orchards, and automation with AI is steadily making its way into farming and agriculture.

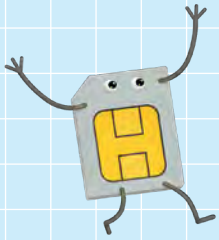
A Café with a Robot

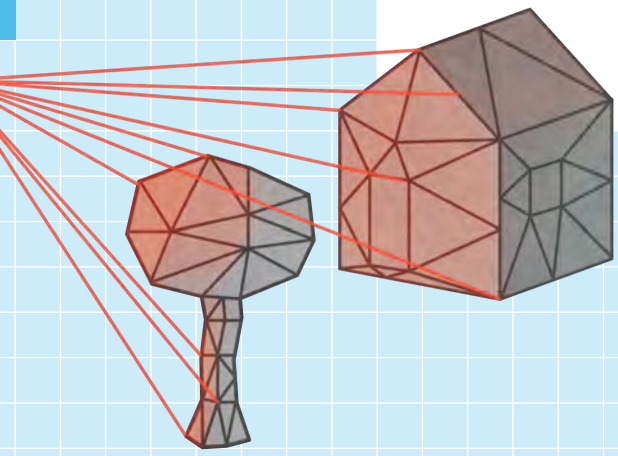
A vending machine does not have to be just a box with a window. A robotic arm or another technical solution can replace human work even in everyday places such as cafés or restaurants.

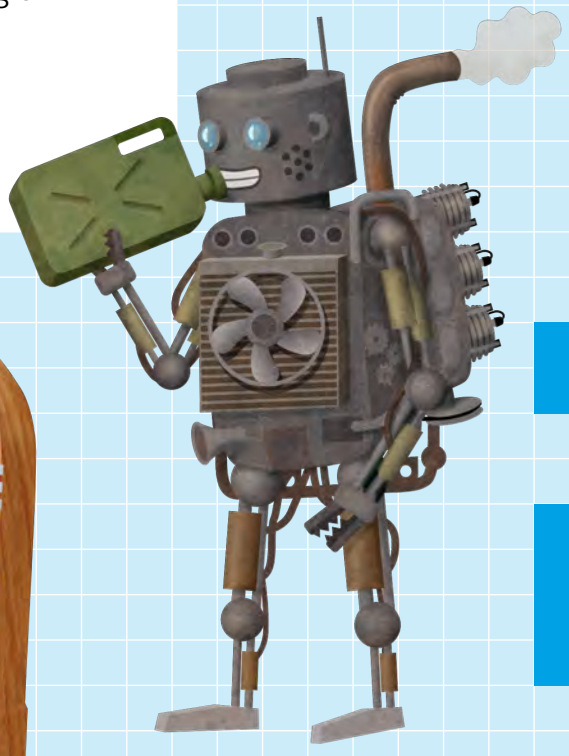


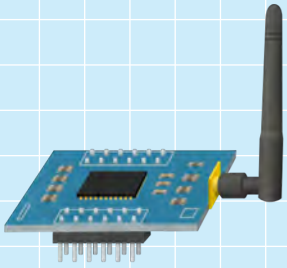
SMART MACHINES

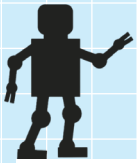
Today, people come into contact with all kinds of modern technology from a very young age. Smartphones, computers, smartwatches, but also vacuum cleaners, credit cards, or drones. So how exactly do modern machines help us in everyday life? You will find the answers in this book. It introduces a wide range of devices and technologies, explains how they make life easier for people, and brings everything to life with fun and engaging illustrations. This book is perfect not only for young scientists and curious explorers who love to experiment and learn new things. It is interesting and useful for everyone, because nowadays we can hardly manage a single day without modern technology.











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