



Curriculum Activities Bionic Chameleon

Assembly

In Manufacturing assembly is an essential step in the production, joining all the single parts into one product. The essential sub-operations of an assembly process are: joining, handling, testing, adjusting or auxiliary operations (e.g. cleaning, heating or cooling for press connections, deburring, unpacking, sealing, oiling, ...) The opposite of assembly is disassembly with appropriate disassembly techniques.

Ideas for activities

Assemble the Bionic Chameleon according to the instructions.

Adaptation

Chameleons are fascinating beings with many special characteristics. They can move their eyes independently. With their protruding spherical eyeballs, they can perceive a large part of their surroundings. They are also well-camouflaged by their body shape. The colour change of a chameleon also serves as camouflage and for communication with conspecifics. The colour spectrum and patterns are species-specific. In danger and combat situations, chameleons can change their colour particularly quickly. The colour can also be changed to regulate their body temperature.



Ideas for activities

Create your own silhouette of a chameleon and color it.

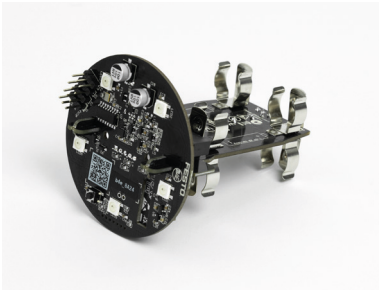


Tongue Shot

The tongue of a chameleon uses the unique combination of force and form closure. This effect can be observed when they are hunting. In a breathtaking way they shoot their tongue out to attack and grab their prey safely. Holding on to the prey is just as important for food intake as the slinging mechanism. It is assumed that adhesion (stickiness), form closure and suction serve to hold on to the prey. Of the many characteristics of a chameleon, the adaptable grasping is of particular interest for technology. Grasping is of fundamental importance for automation. A robotic gripper with a soft tip is something new in factories.

Ideas for activities

Learn more about the chameleon tongue shot - <https://youtu.be/1XO-7f6KWk4?list=PLUiExWPQJKYrJSQ8MrCFZ8JgF4f05MpC>
Grip various objects with the silicone cap of the gripper element e.g. foam rubber, pencil, scissors.



Microcontroller

A microcontroller is a single-chip computer system. Microcontrollers are semiconductor chips that contain a processor and a peripheral function at the same time. Microcontrollers are usually programmed in different languages like Assembler, C or C++.

Ideas for activities

Microcontroller / Programming

Getting to know the controller and its features

Programming with Open Roberta Programming with C++ <https://lab.open-roberta.org/> or GitHub <https://github.com/pm-b4e/Bionics4EducationKit>

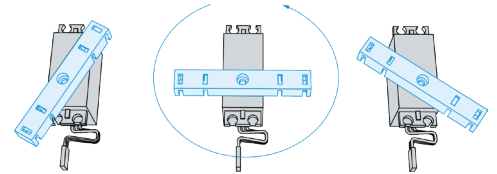
Actuator System

A servomotor consists of a motor, sensors and a controller. The sensors measure the position of the shaft, and the controller moves the motor until the desired position is reached. The bionic kit contains four integrated servo motors to drive the bio inspired robots.

Ideas for activities

Explain, compare and evaluate actuator system:

- How does the servo work?
- Which alternative drives do you know?
- How does muscles work?



Characteristics

The soft tip of the chameleon gripper can adapt to objects of different shapes and can grip and hold them securely - always with one and the same tool. Common grippers must change the gripping jaws depending on the objects shape, size, weight and surface. The force is also distributed relatively evenly over the gripped object without creating pressure points. This means that soft objects, e.g. fruit, can also be gripped.

Ideas for activities

Optimization

- Getting to know gripping concepts in nature
- Experiment how the bionic-inspired chameleon grab can be better controlled with air (pressure) changes

Find other gripper types used in manufacturing.

Construction

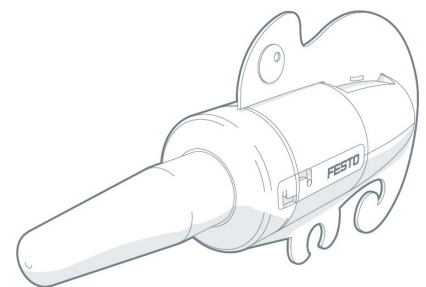
Design is about creating something technical CAD software tools (Computer-Aided Design) are often used to make the design process faster and achieve digital twins of the product more easily. Festo Didactic recommend to use the web based 3D CAD System Onshape (www.festodidactic.onshape.com).

Ideas for activities

Designing additional parts with CAD

Redesign of the chameleon body or other parts.

3D CAD files available on our Website.



Control and Closed Loop Control

Control means to influence a physical value of a system in open loop. Closed loop control means to measure the physical value and react to any change immediately in order to keep this value in a desired range. For the chameleon you can serve as a human controller with your smartphone.

Ideas for activities

Understanding the input-processing-output scheme Control of the chameleon during the gripping process Accompanying courseware: Visit Festo LX <https://lx.festo.com/de>



You will find all download materials here:
<https://www.stem.festo.com/downloads>

Any further information about the Bionic Chameleon:
<https://www.stem.festo.com/bionicchameleon>