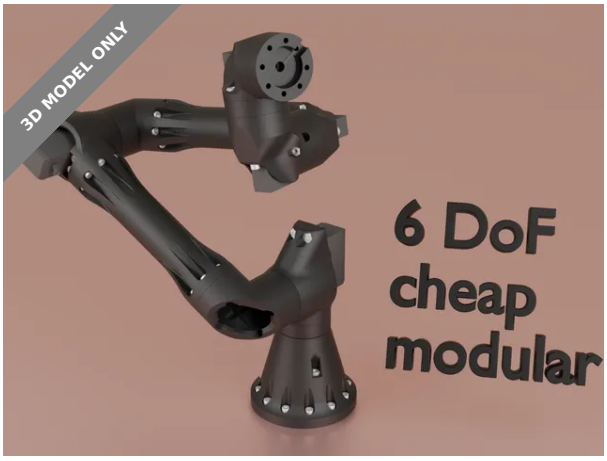


6DoF robot arm | modular | cheap | educational

s **sydaio**

VIEW IN BROWSER

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Summary

A modular system to construct cheap robot arms. Good for education & testing, bad for actual tasks & lifting things.

Hobby & Makers > RC & Robotics

Tags: robot modular arm robotics cheap 6dof

This is a modular system with which many kinematic chains, aka robot arms, can be constructed.
The modules can be seen in image 1. The chosen actuators are very cheap servo motors without gearbox, which brings advantages and disadvantages with it:

- **Low price and simplicity.**
  Big servos (MG996R, ~8€) and small servos (MG90S, ~3€) directly drive the succeeding segment. No additional rotation encoders or gearboxes needed. Each intermediate module only needs two printed parts, a bearing (20x32x7mm, ~1,50€. 2x for base), the actuator and some bolts. It can be controlled with a very cheap microcontroller (ESP8266, ~5€).
- **Limited strength and smoothness.**
  When supplied with their respective maximum rated voltages (7.2V / 6V), this specific arm can easily move and lift its own weight, even

when fully extended. Additional load however will quickly overwhelm the servo motors. Furthermore, motion smoothness cannot properly be achieved through software, as the position control loop is integrated into the actuators.
Heavy damping would likely solve the smoothness problem, but I did not find any rotational dampers that fit the budget.

- **Limited reachability.**
  This system cannot utilize continuous rotation servos, as they cannot control their position. The servo version with limited actuation range (180° for the small ones, 180° or 270° for the big ones) must be used. This obviously limits the range of the robot.

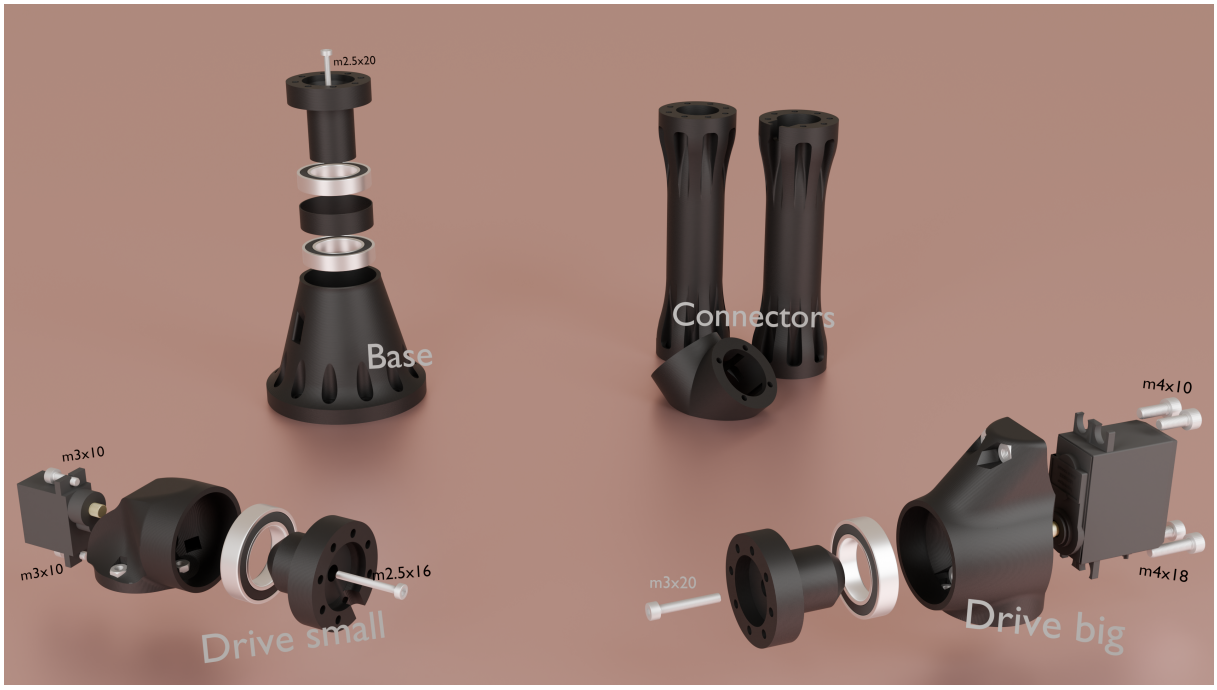


Image 1: Different modules and how they are assembled. The modules themselves are connected to one another using more m3 bolts of varying lengths, mostly m3x10.

This is a system for quick and cheap hands-on experience with robot arms. Things like forward/inverse kinematics, configuration space/ workspace control and the Jacobean matrix can be thoroughly tested and taught with it. The specific 6DoF arm in picture 2 includes around 50€ in material, including both bought and printed. This is a relatively cheap price for a 6DoF desktop robot arm.

This is certainly not a system to perform tasks or lift things around. Yet. I am currently working on a second version which will hopefully use continuous 360° actuation and smoother control loops.
But in its current form, the arm can mostly be used for educational purposes.



Image 2: Assembly of specific configuration that I built, a 6DoF robot arm.

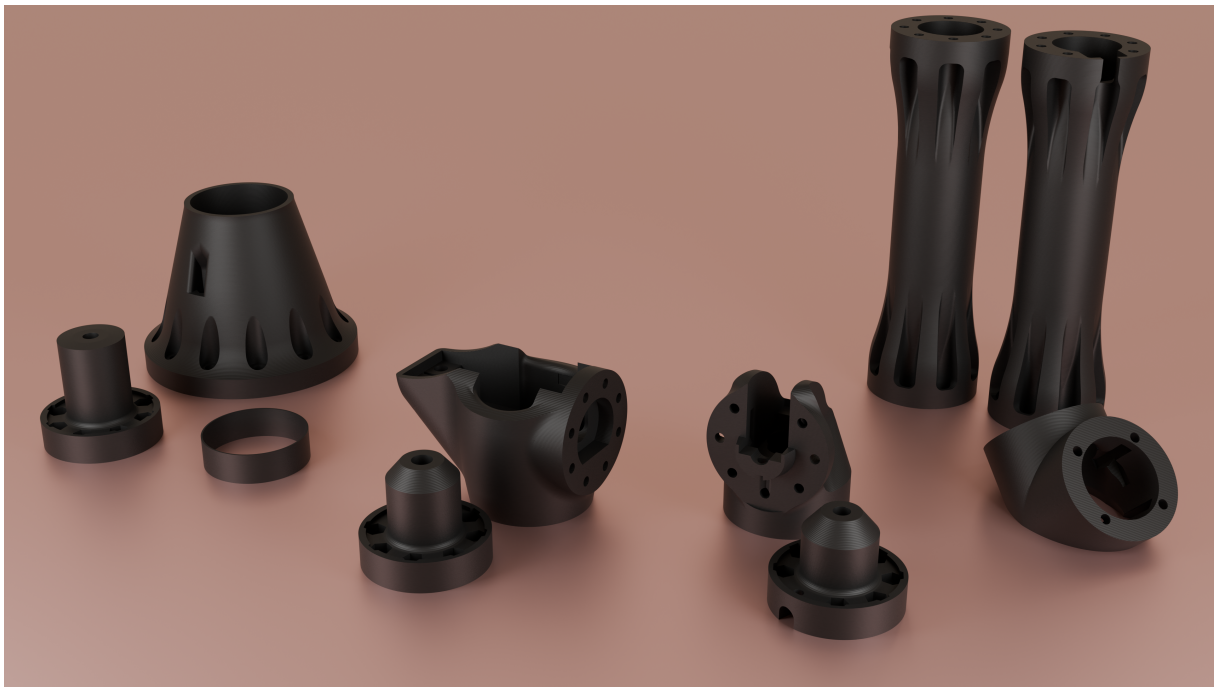


Image 3: all printable parts in their optimal printing orientation

Should you want to use other servo motors with similar size, make sure that their shaft is metal as the rotor parts need to be forced onto that shaft to form a connection that can transfer torque.

The servo models I used to render the images can be found here:
MG90S & MG996R

Model files

STEP files 9 files



base.stp



base_spacer.stp



base_rotor.stp



drivesmall.stp



drivesmall_rotor.stp



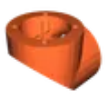
drivebig.stp



drivebig_rotor.stp



connector_straight.stp



connector_corner.stp



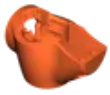
base.stl



base_spacer.stl



base_rotor.stl



drivebig.stl



drivebig_rotor.stl



drivesmall.stl



drivesmall_rotor.stl



connector_straight.stl



connector_straight_shifted.stl



connector_corner.stl

Other files



microrobot_smallerfilesize.zip

.blend file that I used to make the title image, was requested in the comments

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