

## SUSTAINA-OP™



<b>Robot name</b>	SUSTAINA-OP™ (RoboCup2023 Edition)
<b>Height</b>	650 mm
<b>Weight</b>	5.3 kg
<b>Walking speed</b>	Max. 33 cm/s
<b>Degrees of freedom</b>	19 DoFs
<b>Actuators</b>	10 × B3M-SC-1170-A (KONDO) 9 × B3M-SC-1040-A (KONDO)
<b>Sensors</b>	<b>3 axis-gyro. &amp; 3 axis-accel.:</b> 1 × ICM-42688-P (TDK InvenSense) <b>Camera:</b> 1 × e-CAM50_CUNX (e-con Systems) with wide-lens: S02512512524F (TOWIN) <b>Strain gauge:</b> 8 × SC700-40kg (Sensor and Control Co., Ltd.) <b>Encoders:</b> 19 × Contactless magnetic 12bit/1round in actuators
<b>Computing units</b>	<b>SoM:</b> 1 × Jetson Xavier NX (NVIDIA) <b>Carrier board:</b> 1 × A203 V2 (Seed studio) <b>Sub microcomputer:</b> 3 × SAMD21G18 on board Seeeduino XIAO (Seed studio) 1 × ATmega32U4 on board DEV-12640 (Sparkfun)
<b>Battery</b>	1 × LiHv 11.4V 3S1P 2800mAh HP-G830C2800S3 (Hyperion)
<b>Materials</b>	<b>Duralumin:</b> ankles, knees, hips, shoulders, necks, and other joints, e.g., at the base of joints, etc. <b>GFRP:</b> foot, leg links, arm links, torso, neck, etc. <b>POM:</b> box with electronic in the abdomen. chest, arm, neck, and other diagonal braces, e.g., etc. <b>TPU:</b> chest, abdomen, and waist bumpers. <b>PLA:</b> hands, face, etc.
<b>Electronics</b>	1 × SUSTAINA Core Board Rev. 1 (for power input switching and power distribution) 1 × A203 V2 Expansion Board Rev. 2 (for USB-HUB and communication indicators) 1 × IMU Measurement and Transmission Module Rev. 1 (for IMU processing) 1 × USB to Quad RS-485 Conv. Module Rev. 1 (for communication with actuators and sensors) 4 × Power Monitor Module Rev. 2 (for power measurements.) 1 × USB-HID Control Switches Module Rev. 1 (for control buttons) 1 × Buck-Boost Switch Mode Power Supply Module Rev. 1 (for generating power for computing boards) 2 × Quad Load Cell Amplifier to RS-485 Conv. Module Rev. 1 (for communication with strain gauges) 1 × ICM-42688-P-Module Rev. 1(for IMU breakout board)