Upper Limb Exoskeleton

Modular Design

Shoulder Exo Module

Elbow Exo Module

Wrist Exo Module

Shoulder (2 DOF)

Elbow (1 DOF)

High Torque Density Motor

Fabric Soft EMG Sensor

IMU Sensors

Wrist (1 DOF)
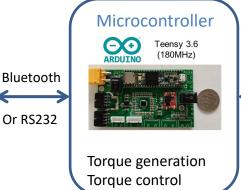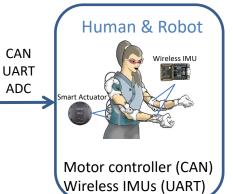
Hand (1 DOF)

Motor Specifications

Motor Specifications	
Motor Size	Ø98 mm x 43mm
Motor Nominal Voltage	48 V
Motor Nominal Torque	9 Nm
Motor Nominal Speed	165 RPM
Motor Nominal Power	240 W
Motor Max Stall Torque	21 Nm
Motor Weight	630 g
Motor Gear Ratio	6:1
Encoder	16-bit magnetic encoder

Actuator Specifications	Design	Ratio
Shoulder Torque	12 Nm	12 : 1
Shoulder Motion	-30-170°	
Elbow Torque	2 Nm	6 :1
Elbow Motion	30-180°	
Wrist Torque	0.33 Nm	1 : 1
Wrist Motion	-80-80°	
Angular Speed	> 15 rad/s	
Backdriving Torque	< 10 %	
Weight (5 actuators)	1.2 Kg	

Master Computer

Visualization
Parameter tuning

Bluetooth

Or RS232

Microcontroller

Teensy 3.6 (180MHz)

Torque generation
Torque control

CAN UART ADC

Human & Robot

Wireless IMU

Smart Actuator

Motor controller (CAN)
Wireless IMUs (UART)

Control Specifications

Control Specifications	
Control Loop	Torque/Speed/Position loop
Master Computer Communication	Bluetooth, USB (RS-232)
Microcontroller communication	RS232, CAN bus
Control Platform	Simulink or Python
API Support	Serial, CAN, USB

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