Table S1: Comparison of the proposed rehabilitation gloves with those mentioned in previous literature.

	Component	Function
Y Zhu et al.[1]	Flexible gloves composed of bending brake, rotating brake, bending sensor, and force sensor	Improve grip ability
X Chen et al.[2]	Sensory gloves (force and bending sensors), sports gloves (tendon driven)	Mirror therapy and task oriented therapy, sports gloves only support flexion movements
Y Chen et al.[3]	Tendon driven flexible gloves	Improve grip ability
P Ben-Tzvi et al.[4]	Cable driven robot tactile exoskeleton device	Measure finger and thumb movements to assist in hand grasping movements
J Yi et al.[5]	Flexible gloves driven by cables	Assist in hand bending and stretching, achieving full range of finger movement
Our Personalized and Safe Soft Glove	Flexible gloves composed of bending sensors, pressure sensors, and pneumatic actuators	Evaluate hand bending threshold to achieve multimodal bending and stretching movements of fingers within a safe range

Reference

1. Zhu, Y.; Gong, W.; Chu, K.; Wang, X.; Hu, Z.; Su, H.J.S. A Novel Wearable Soft Glove for Hand Rehabilitation and Assistive Grasping. *Sensors* **2022**, 22, 6294. doi:10.3390/s22166294.
2. Chen, X.; Gong, L.; Wei, L.; Yeh, S.-C.; Da Xu, L.; Zheng, L.; Zou, Z.J.I.T.o.I.I. A wearable hand rehabilitation system with soft gloves. *IEEE Transactions on Industrial Informatics* **2020**, 17, 943-952. doi:10.1109/TII.2020.3010369.
3. Chen, Y.; Tan, X.; Yan, D.; Zhang, Z.; Gong, Y.J.I.j.o.t.e.i.h.; medicine. A composite fabric-based soft rehabilitation glove with soft joint for dementia in Parkinson's disease. *IEEE journal of translational engineering in health and medicine* **2020**, 8, 1-10. doi:10.1109/JTEHM.2020.2981926.
4. Ben-Tzvi, P.; Ma, Z.J.I.T.o.N.S.; Engineering, R. Sensing and force-feedback exoskeleton (SAFE) robotic glove. *IEEE Transactions on Neural Systems and Rehabilitation Engineering* **2014**, 23, 992-1002. doi:10.1109/TNSRE.2014.2378171.
5. Yi, J.; Chen, X.; Wang, Z.J.I.R.; Letters, A. A three-dimensional-printed soft robotic glove with enhanced ergonomics and force capability. *IEEE Robotics and Automation Letters* **2017**, 3, 242-248. doi:10.1109/LRA.2017.2737481.

Table S2: Implementation of different states in a single branch.

Pneumatic circuit status	Pneumatic actuator deformation	two-position two-way solenoid valve	two-position three-way solenoid valve	Inflatable pump	Exhaust pump
Inflatable status	Expansion	0 *	0	0	1
Keeping in shape	Stationary	1 *	0	0	1
Exhaust status	Systolic	1	1	0	0

* 0: Power on
* 1: Power failure

Table S3. 13 gestures in three modes, adapted from[20].

Rehabilitation Training Model	Gestures		Brief description
fine training		FT	flex thumb
		FI	flex index finger
		FM	flex middle finger
		FR	flex ring finger
		FL	flex little finger
functional training		CH	close hand
		FTI	flex thumb and index finger
		FTM	flex thumb and middle finger
		FTR	flex thumb and ring finger
		FTL	flex thumb and little finger
Gesture training		OK	flex thumb and index finger, extend middle, ring and little finger
		VICTOR	flex thumb,ring and little finger, extend index and middle finger
		Orchid finger	flex thumb and middle finger, extend index, ring and little finger

Table S4. Characteristics of subjects.

Index	Patients
Number	8
Age (min/max)	63/68
Disease type	Stroke/Parkinson's disease/traumatic fracture
The average age of illness (years)	9±0.77

Table S5: Bending sensor calibration results.

Bending angle (◦)	Resistivity (kΩ)				
	01	**02**	**03**	**04**	**05**
0	7.2	7.3	7.3	7.5	7.4
10	7.8	8	7.9	8.1	7.9
20	8.2	8.3	8.1	8.4	8.3
30	9	9.2	9	9.3	9.15
40	9.5	9.6	9.55	9.7	9.65
50	10.3	10.3	10.35	10.5	10.5
60	11	11.15	11.2	11.3	11.3
70	11.45	11.5	11.5	11.6	11.8
80	12.25	12.5	12.4	12.6	12.7
90	12.95	13	13.2	13.1	13.3

Table S6: Bending angle and its corresponding air pressure change in different states of the actuator.

Actuator Status		Thumb	Index	Middle	Ring	Little
Natural status	bending angle (◦)	41.46	39.26	40.69	39.90	39.89
Maximum extension status	bending angle (◦)	15.65	15.34	16.78	15.59	16.73
	air pressure (kPa)	-31.41	-29.43	-29.48	-29.48	-29.83
Maximum flexion status	bending angle (◦)	85.97	89.53	94.27	88.82	88.65
	air pressure (kPa)	103.92	109.52	115.41	108.68	107.97

Table S7: The relationship between air pressure and bending angle during the extension movement of the actuator.

Thumb	air pressure (kPa)	-31.406	-20.98	-15.582	-11.07	-6.123
	bending angle (◦)	15.654	19.6865	21.3785	26.9035	31.4085
Index	air pressure (kPa)	-29.425	-19.885	-14.568	-10.378	-6.27
	bending angle (◦)	15.3405	17.913	19.8515	24.884	31.9435
Middle	air pressure (kPa)	-29.473	-20.53	-15.212	-11.184	-6.511
	bending angle (◦)	16.775	19.712	22.843	25.11	33.9845
Ring	air pressure (kPa)	-29.473	-20.61	-15.535	-10.942	-6.914
	bending angle (◦)	15.594	19.4245	22.8075	25.921	30.5815
Little	air pressure (kPa)	-29.828	-20.288	-14.729	-10.862	-6.672
	bending angle (◦)	16.731	18.0245	21.883	24.916	31.0915

Table S8: The relationship between air pressure and bending angle during the flexion movement of the actuator.

Thumb	air pressure (kPa)	-0.952	20.076	40.62	60.278	80.823	100.481
	bending angle (◦)	41.4555	63.979	74.616	80.155	83.8895	84.753
Index	air pressure (kPa)	0.579	21.768	39.573	60.52	79.534	100.078
	bending angle (◦)	39.2605	64.761	75.034	81.1745	84.832	87.721
Middle	air pressure (kPa)	0.176	20.881	41.587	61.487	80.42	100.642
	bending angle (◦)	40.685	61.7125	76.1115	82	84.074	88.074
Ring	air pressure (kPa)	0.176	20.881	39.412	59.875	80.178	99.917
	bending angle (◦)	39.9025	60.90188	76.16161	81.95885	84.78124	86.11664
Little	air pressure (kPa)	0.176	21.204	39.009	59.956	80.581	100.32
	bending angle (◦)	39.883	63.7235	74.546	81.349	84.803	86.2665

Table S9: Subject's movement thresholds in the rehabilitation training experiment.

	Thumb	**Index**	**Middle**	**Ring**	**Little**
Minimum movement threshold (°)	7.83	17.83	22.36	14.21	5.33
Maximum movement threshold (°)	68.54	79.45	93.96	87.27	86.18

Table S10: Movement thresholds for randomly selected subject in safety assessment experiment.

	Thumb	**Index**	**Middle**	**Ring**	**Little**
Minimum movement threshold (°)	11.159	13.037	20.929	23.481	6.048
Maximum movement threshold (°)	53.578	71.491	90.934	55.253	79.962

Table S11: Minimum movement threshold of each finger during 6 sessions of "CH".

Experiment No.	Thumb angle (°)	Index angle (°)	Middle angle (°)	Ring angle (°)	Little angle (°)
1	13.044	15.702	23.636	25.394	8.86
2	12.466	15.374	22.965	25.131	8.638
3	12.273	14.557	21.764	24.604	7.756
4	12.658	15.374	23.233	24.867	9.23
5	12.562	14.883	22.965	24.604	8.49
6	12.755	15.21	23.233	24.736	8.343

Table S12: Maximum movement threshold of each finger during 6 sessions of "CH".

Experiment No.	Thumb angle (°)	Index angle (°)	Middle angle (°)	Ring angle (°)	Little angle (°)
1	51.284	68.838	89.334	53.857	80.549
2	52.809	74.279	89.334	54.619	79.436
3	50.779	71.849	88.967	54.314	78.057
4	49.899	70.587	88.783	53.857	75.21
5	47.784	66.621	88.783	53.857	75.747
6	52.809	73.379	88.783	53.857	76.829

Table S13: Consistency analysis of the actual minimum movement threshold and the target minimum movement threshold of the five fingers.

	Thumb	**Index**	**Middle**	**Ring**	**Little**
Average value	-1.467	-2.146	-1.704	-1.408	-2.505
SD	0.263	0.406	0.928	0.316	0.499
95% CI	-1.983 – -0.951	-2.942 – -1.350	-3.522 – 0.114	-2.028 – -0.789	-3.482 – -1.528

Table S14: Consistency analysis of the actual maximum movement thresholds of the five fingers and the target maximum movement thresholds.

	Thumb	**Index**	**Middle**	**Ring**	**Little**
Average value	2.684	0.566	1.937	1.193	2.324
SD	1.906	2.868	0.270	0.329	2.098
95% CI	-1.051 – 6.419	-5.055 – 6.186	1.407 – 2.467	0.548 – 1.838	-1.788 – 6.436

Table S15: Technical specifications of the glove.

Index		
Sensors	Weight	128 g
	Type	Bending sensor and air pressure sensor
	Quantity (each)	5 bending sensors and 5 air pressure sensors
	sensitivity	The resistance tolerance of the bending sensor is ± 30%, and the accuracy of the pressure sensor module is ± 1%
Processor	Type	ARM Cortex M3 processor
	Frequency	72 MHz
	Power supply	12 V, 11200 mA lithium battery combined with AMS1117 series voltage regulator chip
Function and characteristics	Support gesture types	Fine training (“FT”, “FI”, “FM”, “FR”, “FL”), functional training (“CH”, “FTI”, “FTM”, “FTR”, “FTL”), hand gesture training（“OK”, “VICTOR”, “Orchid finger”）
	Real-time feedback	Bending feedback control
	Software application	Human machine interaction interface in LABVIEW environment

Figure S1: Bending sensors conditioning circuit.

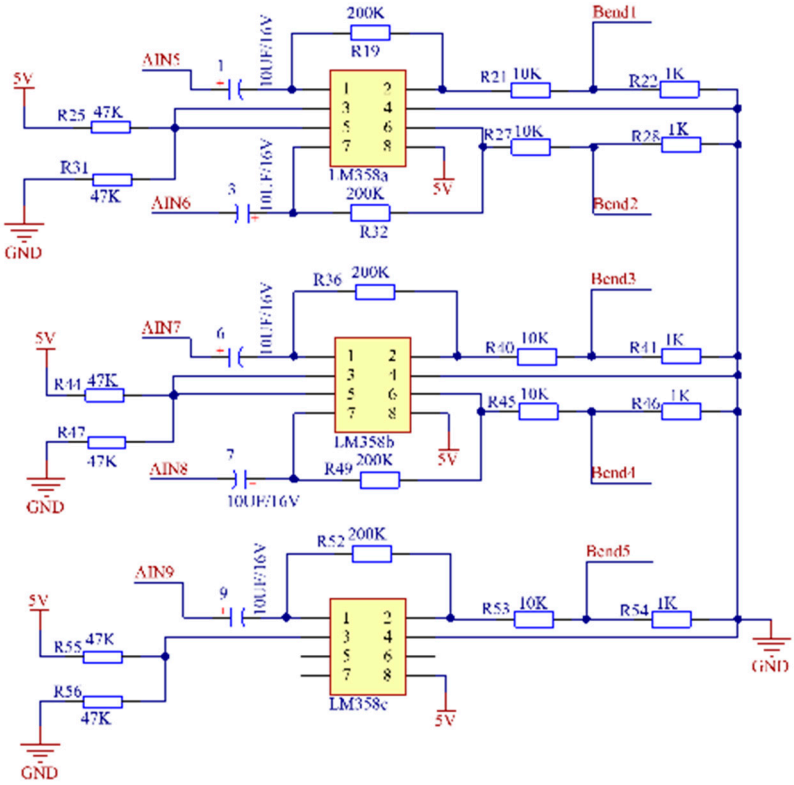

Figure S2: The circuit schematic of the main control module.

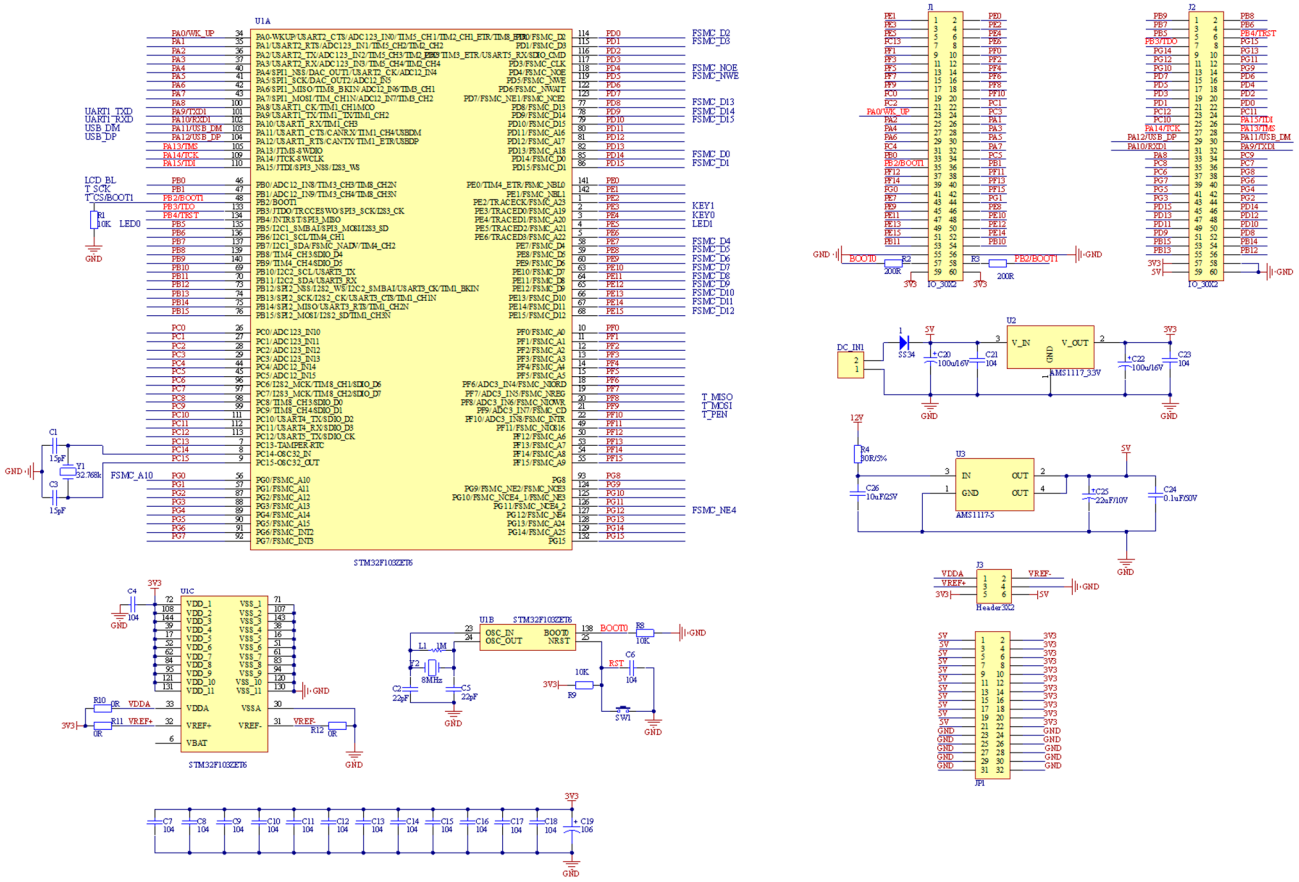

Figure S3: The process of rehabilitation training control.

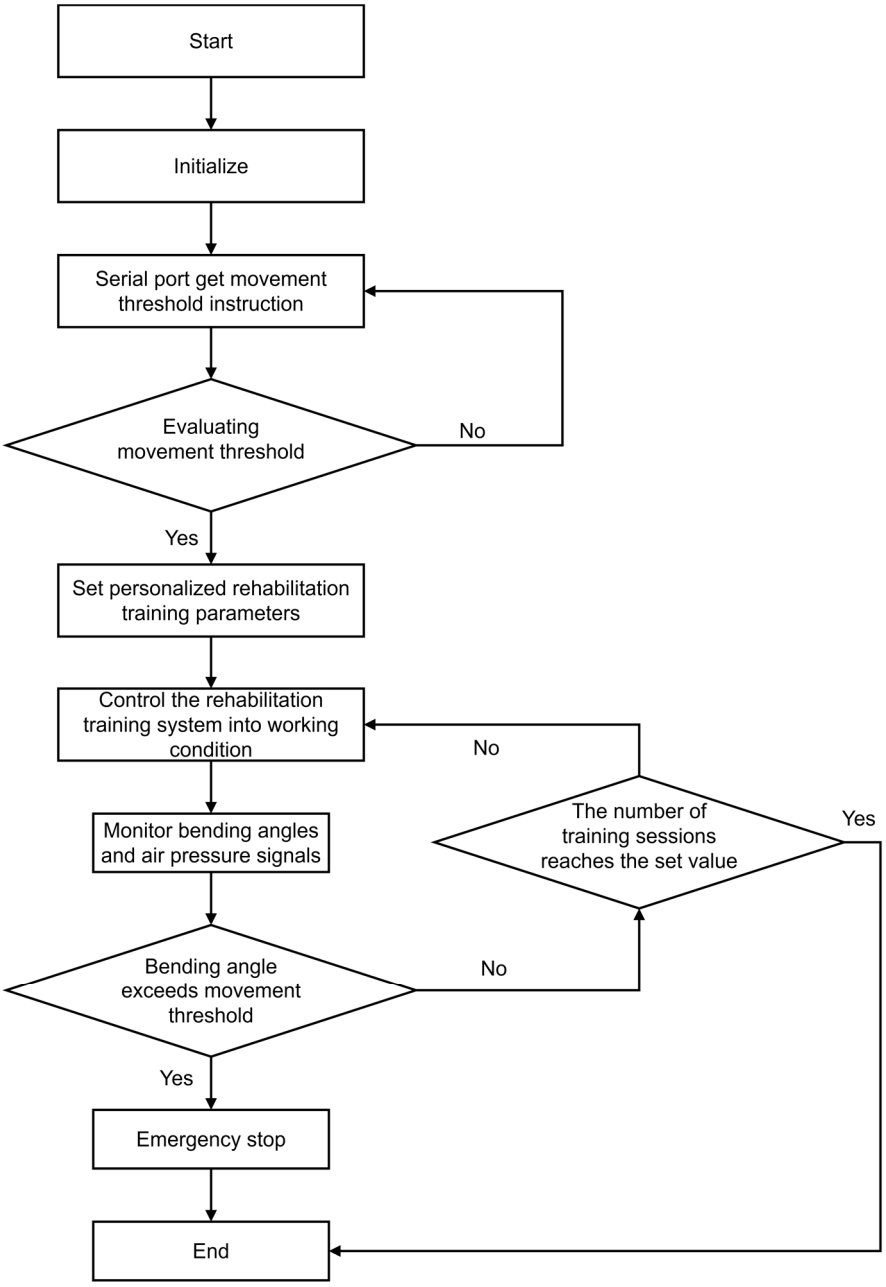

Figure S4: The effect of "fine training" and the change of bending angle of five fingers. (a) “FT”; (b) “FI”; (c) “FM”; (d) “FR”.

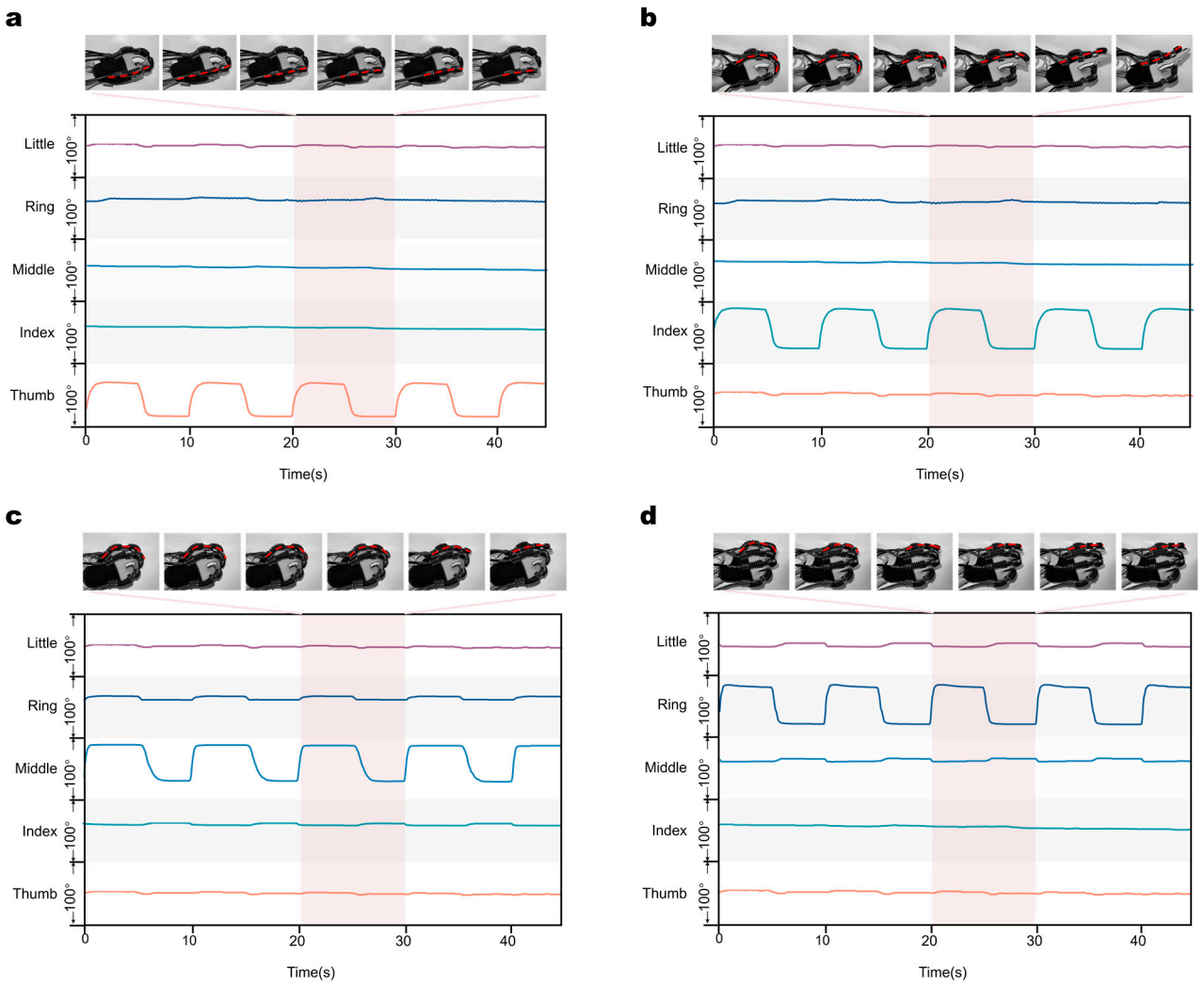

Figure S5: The effect of "functional training" and the change of bending angle of five fingers. (a) “CH”; (b) “FTI”; (c) “FTM”; (d) “FTL”.

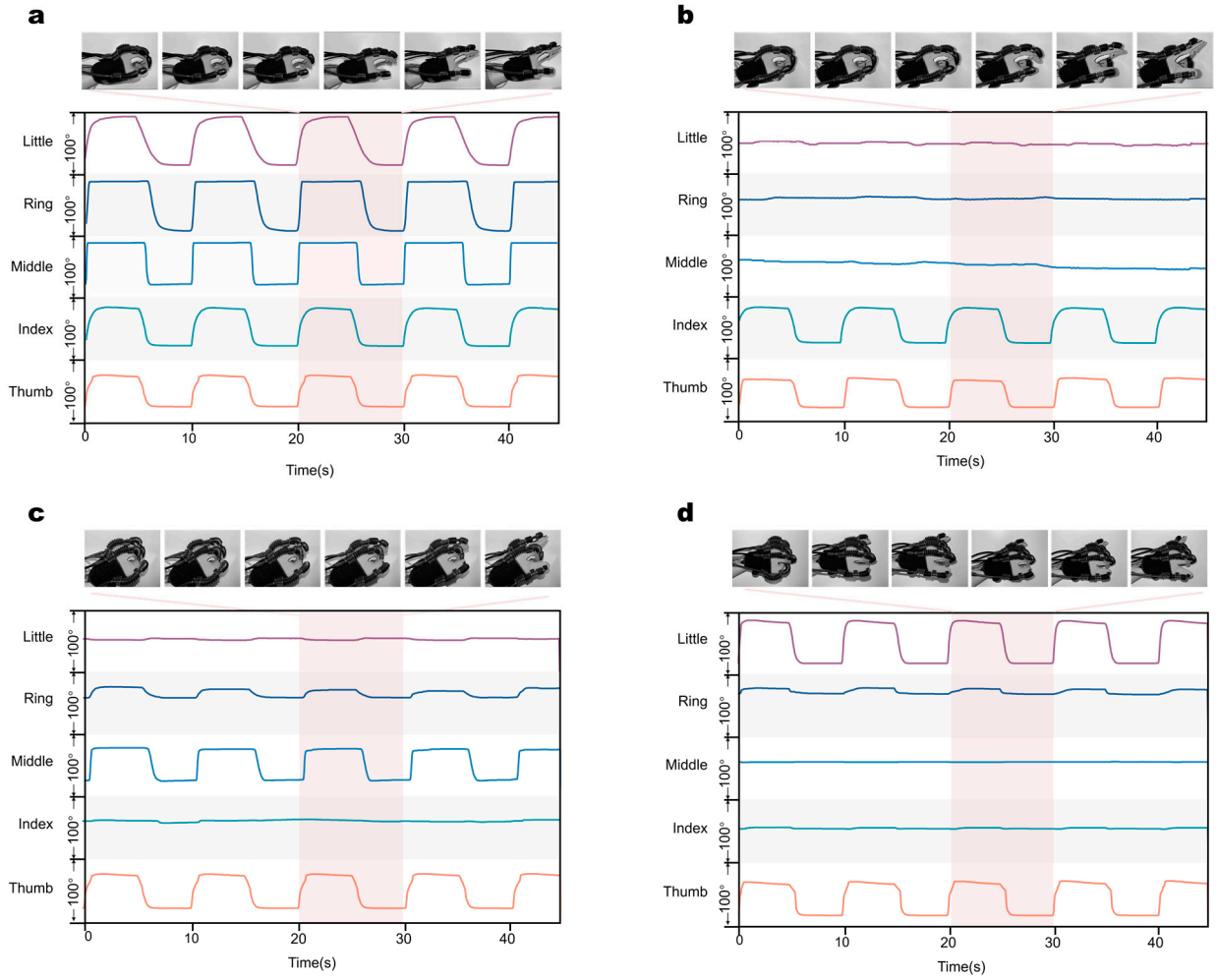

Figure S6: The effect of "hand gesture training" and the change of bending angle of five fingers. (a) “OK”; (b) “Orchid finger”.

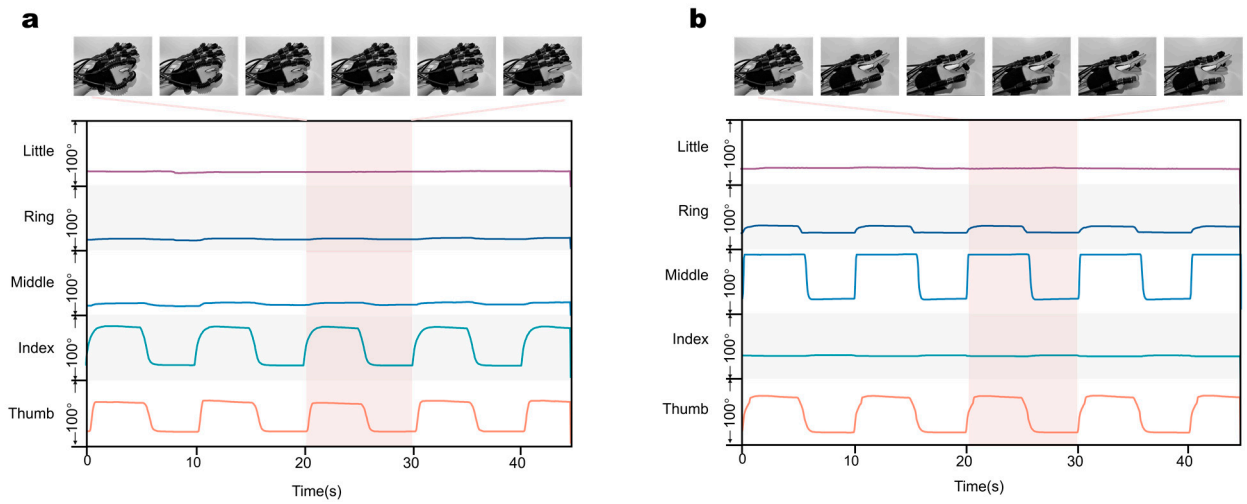

Figure S7: The five-training box line figure for system security assessment.

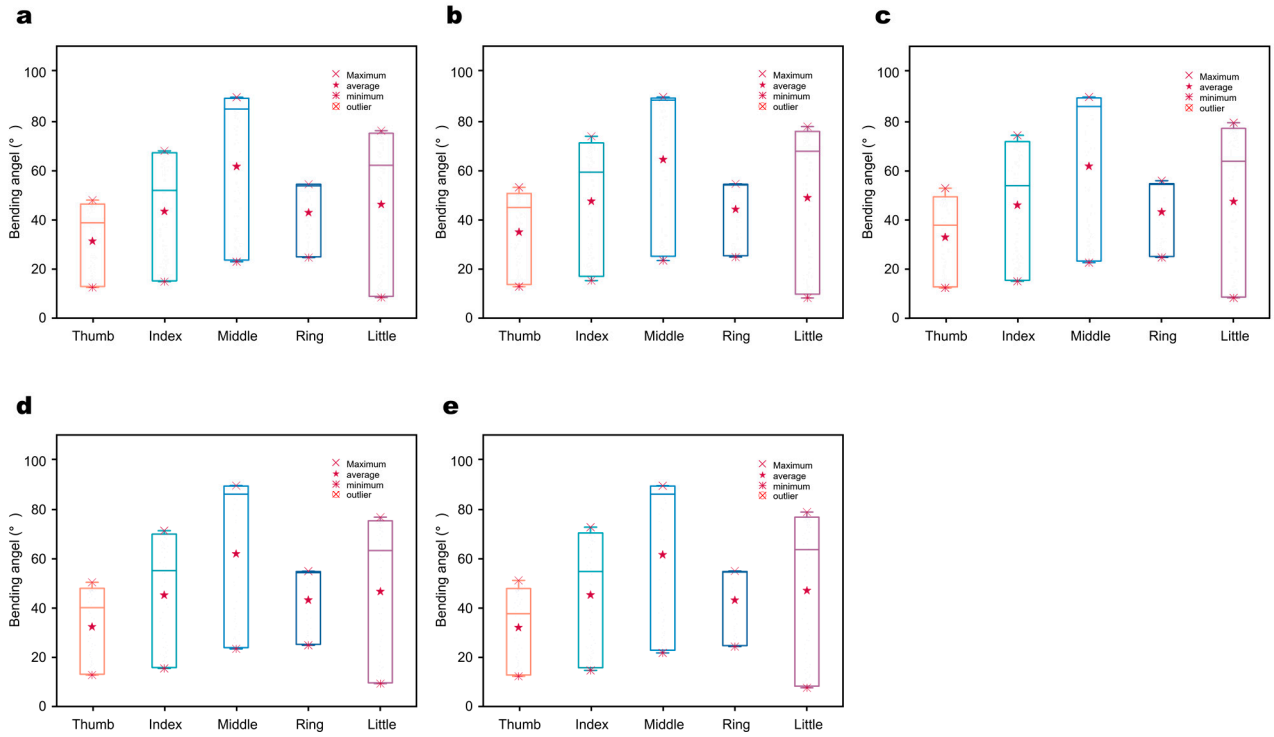

Figure S8: Flexible rehabilitation gloves physical picture.