Active Finger & Hand
Rehabilitation Solution

RAPAEL

SMART GLOVE

NEOFECT

RAPAEL SMART REHAB SOLUTION

Intensive Repetitive Task-oriented	+	Learning Schedule Algorithm for rehabilitation Individualized adaptive training

RAPAEL
SMART GLOVE

REAL-TIME BIOFEEDBACK DEVICE
Lightweight, Ergonomic design
Elastomer material
Wireless connection

RAPAEL
SMART REHAB PLATFORM

GAME-LIKE EXERCISES
Learning Schedule Algorithm
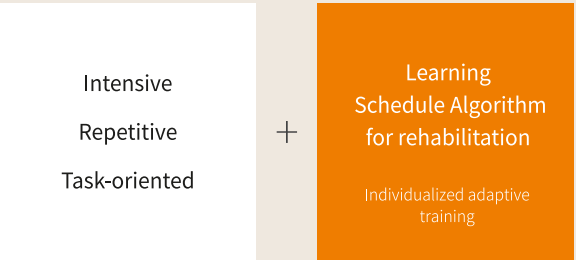Intensive, repetitive, task-oriented training
ADL-related tasks

DATA VISUALIZATION
Biomechanical evaluation(eg. PROM, AROM)
Monitoring training progress

RAPAEL SMART REHABILITATION CONCEPT

RAPAEL Smart Rehabilitation Solution is designed to induce neuroplasticity for hand function of patient with brain damage.

In order to enhance rehabilitation of patients whose extremities are affected by lesions in the central nervous system (eg. stroke), they should practice goal-oriented and task-specific tasks repetitively. However, the repetitive rehabilitation process easily decreases patients' motivation and makes it hard to maintain optimal challenging difficulty and to induce neuroplasticity.
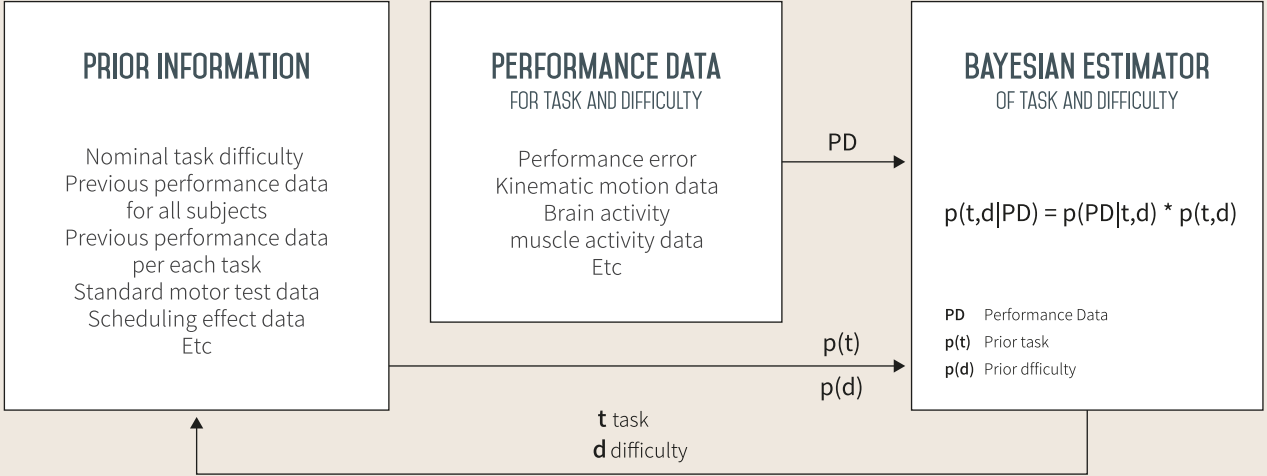
RAPAEL Smart rehabilitation solution applies the 'Learning Schedule Algorithm' to game-like exercises so that patients can remain motivated and can find the exercises gradually challenging.

Hence, therapists no longer have to manually adjust the task's level of difficulty in order to motivate patients. Moreover, objective evaluation of exercises and user-friendly reports on progress allow effective and efficient rehabilitation process management.

LEARNING SCHEDULE ALGORITHM FOR EFFECTIVE MOTOR LEARNING &CONSTANT CHALLENGE

Learning Schedule Algorithm is designed to enhance learning multiple functional tasks by proposing an optimal task in proper challenging difficulty. Based on patient's data such as training progress, prescription, personal interest, motor function scores, and etc, it computationally selects which game to play in which level of difficulty. In RAPAEL solution, a novel UI/UX for task difficulty modulation process makes patients to understand how exercise progresses in real-time.

PRIOR INFORMATION
Nominal task difficulty
Previous performance data for all subjects
Previous performance data per each task
Standard motor test data
Scheduling effect data
Etc

PERFORMANCE DATA
FOR TASK AND DIFFICULTY
Performance error
Kinematic motion data
Brain activity
muscle activity data
Etc

BAYESIAN ESTIMATOR
OF TASK AND DIFFICULTY

$$p(t,d|PD) = p(PD|t,d) * p(t,d)$$

PD Performance Data
p(t) Prior task
p(d) Prior dfficulty

PD

p(t)
p(d)

t task
d difficulty

Ref) Y. Choi, F. Qi, J. Gordon, & N. Schweighofer, Journal of Motor Behavior, 2008, Vol. 40, No. 4, 273–280

RAPAEL SMART GLOVE

KEY FEATURES

LIGHTWEIGHT
132g

1

ERGONOMIC
Design for various joint moving
Easy wearing even for stiff hand

2

ELASTOMER MATERIAL
Easy cleansing
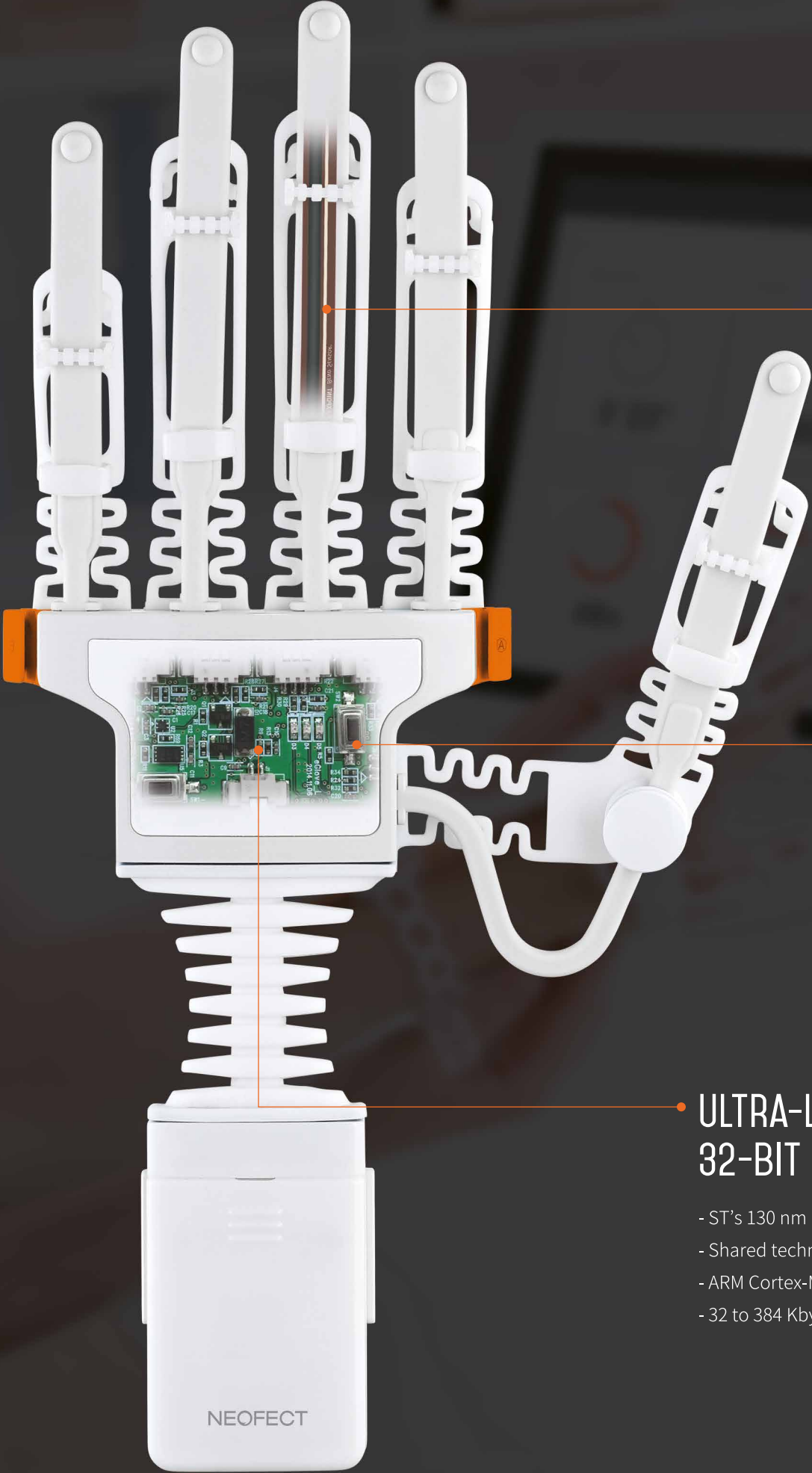Form preservation

3

WIRELESS
Bluetooth connection

4

SENSOR TECHNOLOGY
Bending sensor and 9-axis IMU sensor

5

BENDING SENSOR TECHNOLOGY

Bending Sensor is a variable resistor that changes as it is bent. The sensor is connected to computer system which can accurately compute the amount of individual finger movements. A movement of only one inch can yield over 200,000 data points.
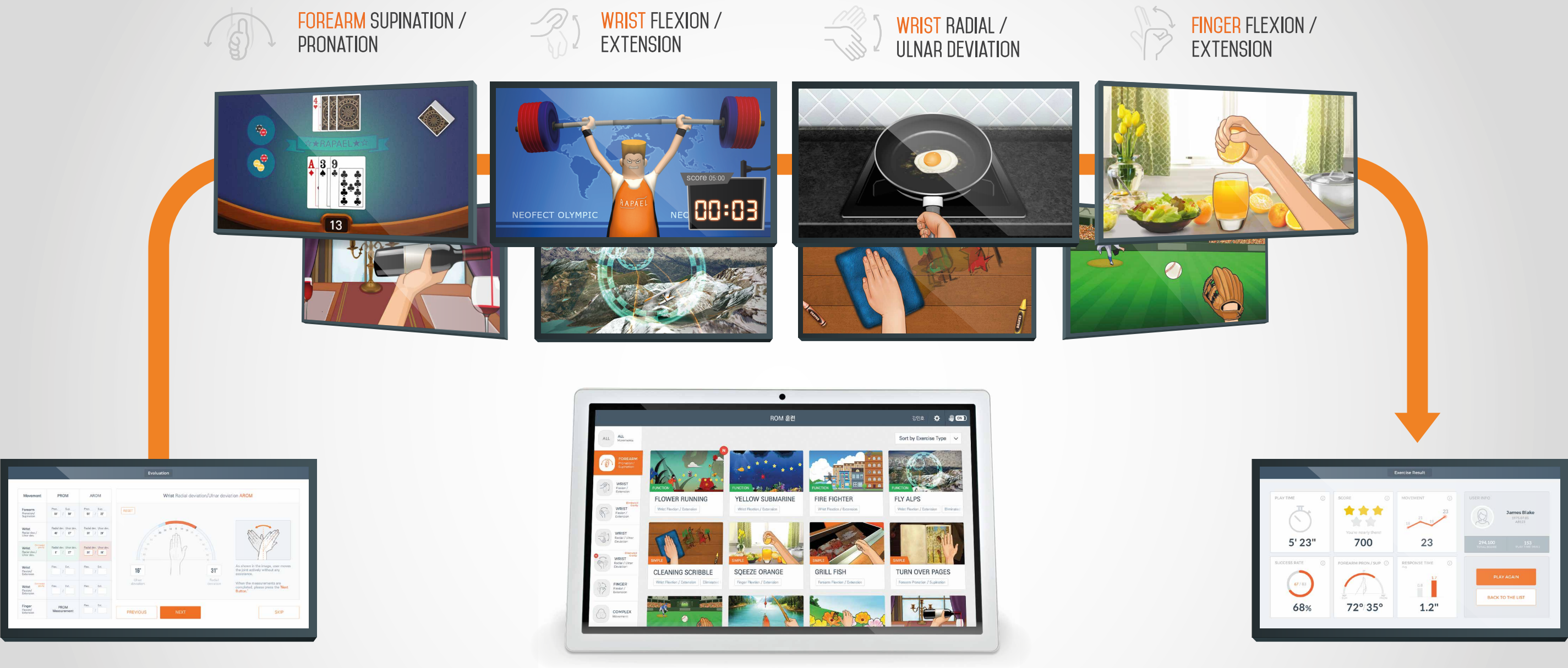
9-AXIS MOVEMENT & POSITION SENSOR

- 3 acceleration channels
- 3 angular rate channels
- 3 magnetic field channels

ULTRA-LOW-POWER ENERGYLITE™ 32-BIT MICROCONTROLLERS

- ST's 130 nm ultra-low-leakage process technology
- Shared technology, architecture and peripherals
- ARM Cortex-M3 core @32 MHz
- 32 to 384 Kbyte Flash, dual bank, RWW

NEOFECT

RAPAEL SMART REHAB PLATFORM

FOREARM SUPINATION / PRONATION

WRIST FLEXION / EXTENSION

WRIST RADIAL / ULNAR DEVIATION

FINGER FLEXION / EXTENSION

EVALUATION

RAPAEL Smart Glove allows a range of bio-mechanical evaluation such as passive and active range of motion and motion analysis of the fingers and hand. Such measured ROMs are applied as the difficulty level of the initial exercise.

GAME-LIKE EXERCISES

RAPAEL Smart Platform provides various kinds of motion tasks such as ADL-related task with entertainment, considering both clinical effectiveness and fun factors. Learning schedule algorithm automatically adjusts optimal level of difficulty game by game so as to balance challenge and motivation.
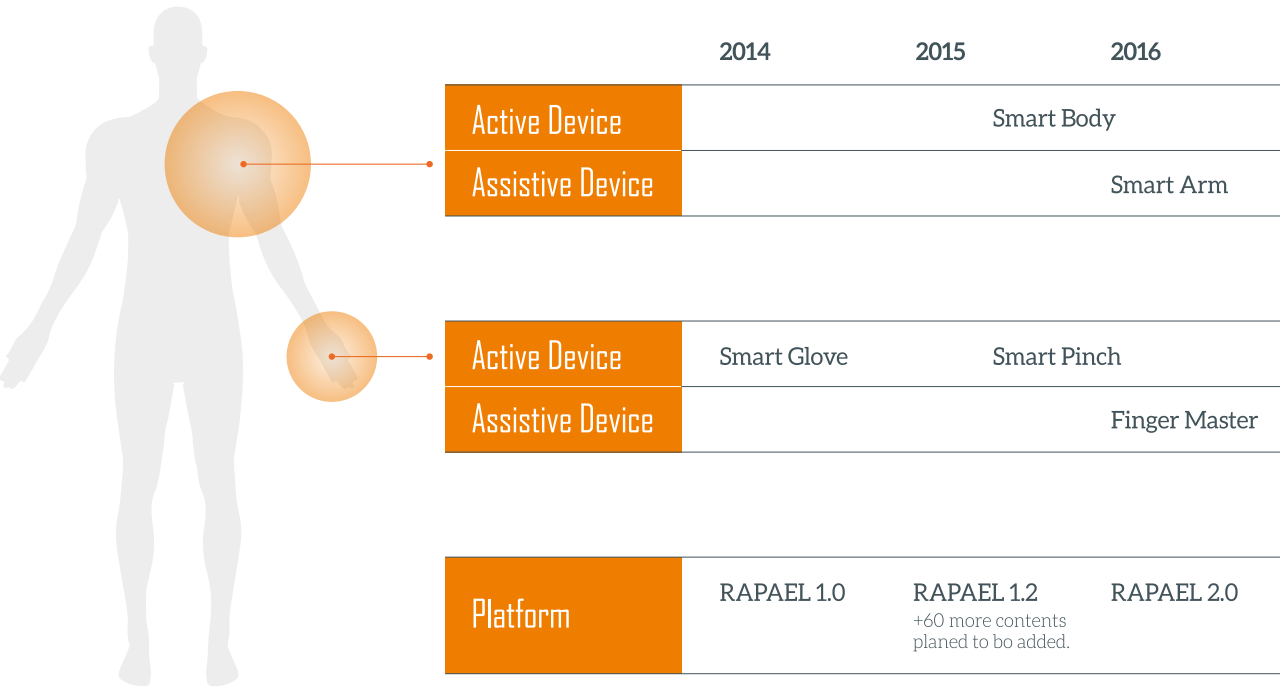
GAME RESULT

A patient can easily interpret his or her own performance right after completing each session of exercise through user-friendly interface and numeric scores for further motivation.
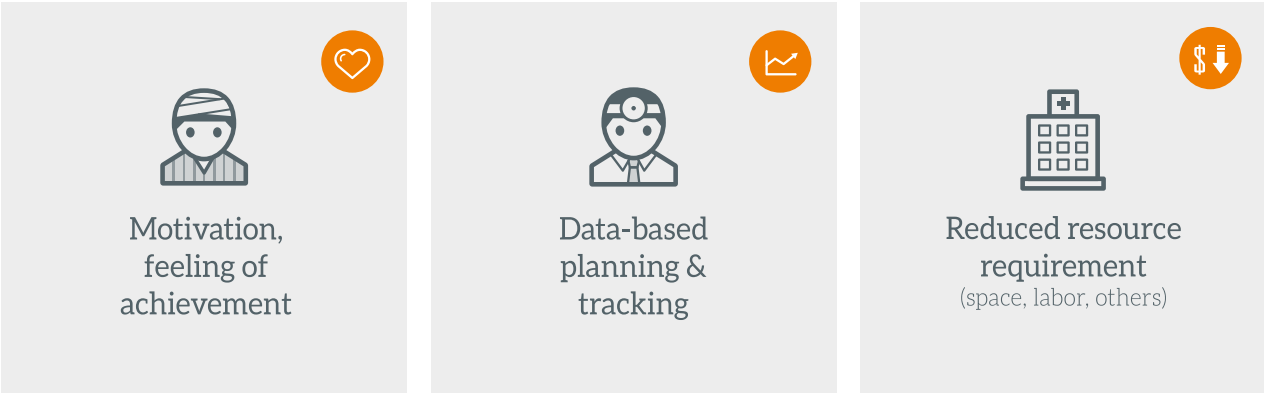
PERFORMANCE RESULT & REPORT FOR PRINTING

Performance result shows patient's current state, exercise progress and improvement by analyzing AROM value measured while exercising.

EXPANSION OF LINE-UP

	2014	2015	2016
Active Device		Smart Body	
Assistive Device		Smart Arm	

	2014	2015	2016
Active Device	Smart Glove	Smart Pinch	
Assistive Device			Finger Master

	2014	2015	2016
Platform	RAPAEL 1.0	RAPAEL 1.2 +60 more contents planed to bo added.	RAPAEL 2.0

KEY VALUES

Motivation, feeling of achievement

Data-based planning & tracking

Reduced resource requirement (space, labor, others)

COMPONENT

Smart Glove: 1pair(Left/Right)

Tablet PC: 1ea

Extra silicone pad: 1pair(Left/Right)

Extra body band: 1pair(Left/Right)

Charger: 1ea

Battery: 3ea

Quick guide: 1ea

Instruction for use: 1ea

Hard case: 1ea

ABOUT NEOFECT

NEOFECT was founded to create hope for better life and better world. NEOFECT believes that any patient is deserved to enjoy happy life with hope for full recovery. NEOFECT has vision to help more patients take advantage of advanced digital and robot tech-

nologies through developing and commercializing light, portable, and affordable rehabilitation solutions. Please look forward to more products to launch and join us in our journey to make meaningful impact through disruptive innovation for patient's hope.

CE FDA MINISTRY OF FOOD AND DRUG SAFETY ISO 13485 BUREAU VERITAS Certification

PRODUCT DEVELOPMENT & CLINICAL PARTNERS

National Rehabilitation Center

Seoul National University

KAIST, Korea Advanced Institute of Science and Technology

UNIST, Ulsan National Institute of Science and Technology

Samsung Medical Center

Yonsei University Hospital

Seoul National University Hospital

Bundang Jesaeng General Hospital

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RAPAEL

We inspire hope

*We won't let stroke survivors
give up their life
until their full recovery.*