Smart Health Enhancement Services Developed by the Adoption of Intel Technologies : Personalized Experience, Effectiveness, and Trackability

With 11th Gen Intel® Core™ processors , Netown Corporation can provide high-quality health enhancement services that can generate personalized plans, effective programs, and trackable records for elderly users and long-term care facility operators.

Netown Healthcare Experience

Established in 2003, Netown Corporation always aims to become the innovator in the healthcare industry by adopting latest technologies for the enhancement of human health and providing end-to-end healthcare solutions. The company implements smart healthcare services via its innovative solution,Babybot, to helpthe elderly to maintain their happiness and well-being and to live independently. Babybot can provide services that include health assessment, health enhancement, and health management with individual, community, and organizational modes for different application scenarios for common users and long-term care facility operators.

Netown has been working with tier 1 medical centers and hospitals, including National Taiwan University Hospital,Chang Gung Medical Foundation, Mackay Memorial Hospital, Landseed International Hospital, and several public hospitals, to make its smart healthcare service more accessible to end users. Babybot can be found in over 500 communities, up to 60 clinics and pharmacies, more than 12 nursing homes and commercial companies. Babybot may be seen in cosmetic chain stores, factories, telecom enterprises, construction firms providing customized healthcare solutions for consumers in each market segment.

CHALLENGES

- **Providing personalized health enhancement plans for each individual.** To evaluate the health status of an individual and to perform analysis taking into account of diversity, and then to set objectives which are suitable for the individual to have effective training.

- **Developing exclusive training solutions for the elderly.** To conduct real-time monitoring of user's training status and to automatically adjust the training load based on user's progress to ensure that the training is adequate and safe.

- **Providing interactive tour experience and innovative dining experience for the elderly.** To create virtual-tour-guide wheelchairs for elderly visitors and smart trolleys in health parks.

SOLUTIONS

- **Providing smart evaluation service for the categorization of the elderly from various aspects.** To evaluate the health status of an individual according to measurement and assessment to recognize the diversity of the individual and to design personalized health enhancement plans based on the results of data analysis.

- **Applying Intel® technology and leveraging Intel® Distribution of OpenVINO™ Toolkit.** To adopt Intel® processors and OpenVINO™ toolkit to seamlessly detect user movement, monitor heartrate by AI face detection,analyze user's progress, and automatically adjust training parameters, which can increase effectiveness and enhance user experience.

- **Applying Intel® technology to make the process of moving smart.** With the powerful Intel® processors installed onto the motorized wheelchairs and automatic trolleys and the 5G high speed network, the interactive virtual tour guide on the wheelchairs can provide customized introduction based on the user's interest, and the smart trolleys can help to deliver meals to a user whenever the user is in the service region.

Population aging has become a global issue. According to WHO, the people who aged 65 years or over accounted for 9% of global population in 2019. However, the percentage is projected to reach 22% in 2050, which means 1 out of every 5 people in the world will be an elder. Taiwan's aging population is also increasing rapidly nowadays. As the population of the elderly grows,frailty and sarcopenia will also become serious problems, and they may increase the demand for effective health enhancement. This challenge can be dealt with aggressive health promotion by precision exercise together with nutrition advice to ensure the elderly can maintain/regain muscle strength.

Netown Corporation has 19 years of experience in the field of telehealth and has already extended its healthcare services into the smart precision exercise and rehabilitation market segments for 5 years. Through the integration of medical information, exercise science, electronics engineering,mechanical design, and Internet systems,Netown dedicates itself to the provision of smart healthcare services. The Babybot, which is one of its innovative healthcare solution, is a comprehensive system that can analyze the health data of a user, conduct health assessment for the user, and generate personalized training plans based on the user's needs.

Netown strongly hopes to promote Babybot as the product of core technology innovation that will extensively benefit individuals, communities, and organizat ons and reach the goal of elevating the elders' quality of life and allowing them to have excellent later life.

Babybot, one of the core technology applications created by Netown for providing smart healthcare services, adopts Intel® Core™ processors to improve the performance on health enhancement, enhancing user experience with its attractive functions.

Babybot®
寶貝機®

> We are highly confident in our product, Babybot, because we apply the solutions based on Intel® Core™ processors, OpenVINO™ toolkit and other innovative technologies to support Babybot s performance.
>
> Yen-Shan Lin, the Chief Executive Officer of Netown Corporation

Improving healthcare experience by user-centered design

"Your Health, Your Life, We Care!" is the slogan of Netown and the concept that drives the company continuously working on how to provide smart healthcare services based on each individual's needs. Besides, Netown is devoted to making Babybot-related products synonymous with high quality, high expertise, and high technology, which are the features its target group is constantly looking for.

Babybot, as a health data recording and management system, has already earned its reputation for wide adoption in medical organizations, communities, and facilities. However, what medical professionals want is a solution that can differentiate the cases of users and suggest required approaches for improving the health of each elder.

Since most cases of frailty and sarcopenia are related to the loss of muscle, Netown expands Babybot's vital sign collection function to include the evaluation and analysis of muscle strength. This makes Babybot the first to market with the capabilities of conducting smart muscle strength measurement and automatically transmitting muscle strength data, and analyzing muscle loss risk level.

Comparing to traditional muscle strength measurement carried out by using a hand dynamometer and a timer, using Babybot can significantly save the time for testing and analysis and can reduce paperwork. On the other hand, Babybot can make before and after comparison done with no sweat at all, no matter that the time period of data is 6 months, 1 year, or 2 years.

"By using Babybot, which is hassle-free and user-friendly, every elder can know whether his or her upper limbs or lower limbs need to be improved in just a few minutes. That's one of the major reasons why Babybot is so attractive to medical centers and hospitals" said Yen-Shan Lin, the chief executive officer of Netown Corporation.

Creating an effective health enhancement service for the elderly with Intel technologies

Netown discovered that the lack of a training system designed for the elderly to help them to regain muscle strength and reduce the risk of injury at the same time is another problem in this field. "There are various kinds of commercial or home fitness equipment in the market, but none of them is especially designed for the elderly. According to studies, the protein absorption rate of the elderly after training is higher than the protein absorption rate of mid-age or young people after training. Therefore, proper exercise and training for the elderly is the key to prevent muscle loss and sarcopenia and can enhance their health," said Prof. Ching-YuChen, an attending physician of the Department of Family Medicine, National Taiwan University Hospital, and the Director of the Division of Geriatric Research, National Health Research Institutes, who was also the superintendent of Taipei Hospital in 1995-1997. Prof. Chen is one of the professionals Netown works closely with.

"In hospital, physicians can guide the elderly on how to exercise properly. However, there is no technical approach to record the data generated during the training. Thus, medical staff needs to keep an eye on the elderly to write down the data manually. More importantly, training is effective only on a daily basis, but physicians are unable to track how the training is going outside the hospital. It is frustrated to see that elders become weaker on return appointments while there is no effective way to encourage them to make improvements to their muscle strength everyday" added Prof. Ching-Yu Chen.
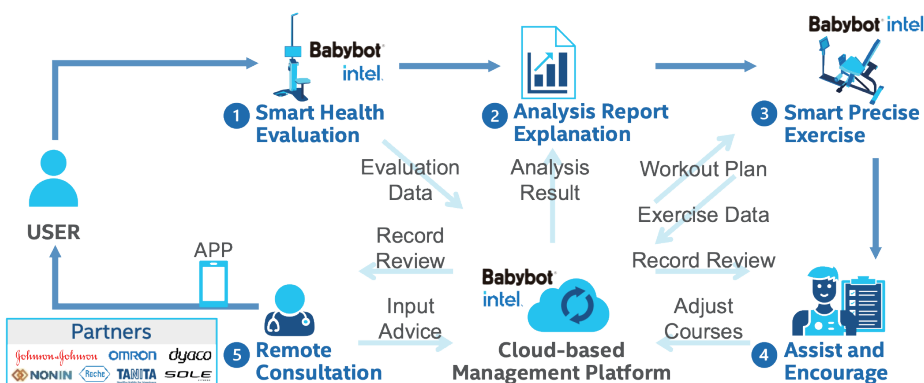

Fig: System architecture of Babybot Smart Health Enhancement System

This strong demand provoked Netown to develop a smart training system which adopted 11th Gen Intel® Core™ processors to integrate motion sensing technology, load adjustment technology, strength detection technology, power calculation algorithm, best training range algorithm, and data transmission technology to be a training system that could create ideal training course for each individual and monitor real-time training progress remotely.

The "motion sensing technology" and "load adjustment technology" utilize the high frequency processors to make the training device able to detect the user's motion and to adjust the training load automatically. This function makes every second in the training process able to be recorded, which can intensively increase the training data for physicians to analyze the training progress of each elder and to adjust the training targets remotely in special cases.

The "strength detecting technology" and "power calculation algorithm" can combine mechanical and electrical engineering concepts and the knowhow in the field of exercise science along with the processing power of Intel® CPUS to turn user's movement into quantitative data. This creates new value for the equipment as it can reveal the muscular power and muscular strength of a user during the process of exercise.

By adopting processors, the training system can scan a first-time user and automatically adjust the training target to fit the user's physical condition, and continuously fine-tune the settings when the user can reach a higher training target. This enhances the safety and ensure the effectiveness of this smart training system.

With the smart training system, the health enhancement services provided by Babybot can make ill elders become healthy again with quantitative evidences, rather than just recording and showing how unhealthy they are. "The innovative services provided by Babybot can fill the gap between the physicians in hospitals and the elderly at home, solving the issue mentioned above and also improving the services by collaborating with local training service providers to offer an effective and safe fitness training programs for the elderly just in the communities," said Yen-Shan Lin, "With the latest version of Babybot, Netown embodies a smart training system that "Knows the users, guides the users, and makes the users better."

AI analytics accelerated with OpenVINO™ toolkit for wellness monitoring in Babybot - AI Smart Heart Rate Safeguard
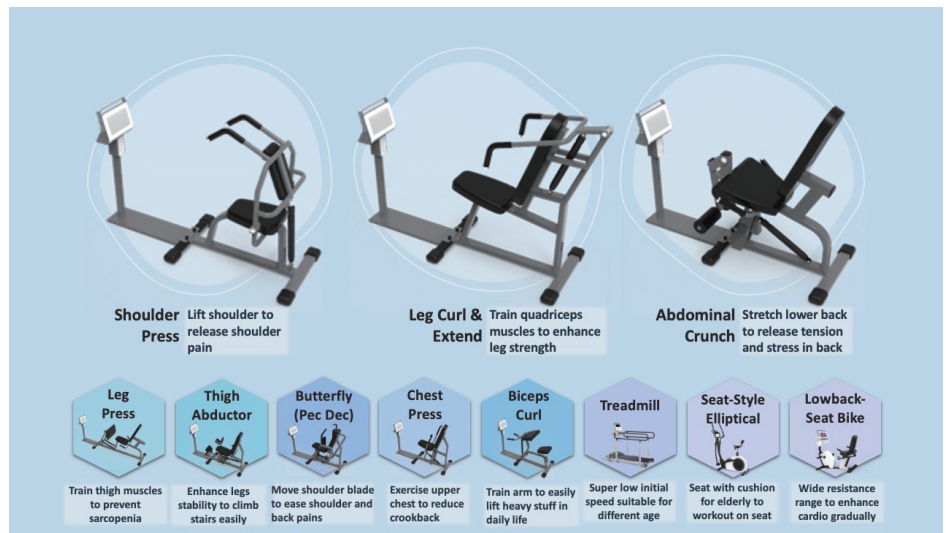

Fig: Smart Health Enhancement Series with Intel® Core™ processors

Heart rate monitoring is important during exercise. It may not only help the user to keep a fat-burning heart rate in the training process to burn the most calories but to ensure that the heartrate of the user does not exceed his or her maximum heart rate (MHR) to be safe during exercise. Heart rate monitoring is not a new idea in the field of smart training, but it always requires wearable sensors for the function. Unfortunately, the elderly is the group who don't like wearable devices the most.

On the other hand, a user usually needs to reduce the training load by themselves with reference to the heart rate monitor in most cases, which may raise the risk for elderly users because of higher possibility of forgetfulness, malfunction of device, and the fear or dislike of advanced technology or complex devices (technophobia). To address this issue, Netown has collaborated with Intel to create supportive AI technologies for the health enhancement services provided by Babybot.

Running AI at the edge without the need of accelerators allows Babybot to optimize AI in monitoring a user's heart rate during his exercise without any wearable device, by using Intel® Core™ processors with integrated GPUs and Intel® Distribution of OpenVINO™ toolkit and integrated GPU. Through real-time

detection of facial color changes and the signal processing performed by AI, the heart rate of the user can be extracted. This technology works on live video streams without applying facial recognition, and therefore there will be no security concerns. With the adoption of algorithm trained using OpenVINO™ toolkit, the accuracy of heart rate estimation can reach 95% (compared with medical grade oximeter). On the other hand, the computing power for heart rate detection AI of Intel® 11th® gen CPU is significantly enhanced up to 153% while comparing with 6th® gen CPU. This upgrade brings 1.3 times faster on heart rate extraction averagely.

Being integrated with AI-assisted Heart Rate Detection Technology with "load adjustment technology", Babybot can track the user's heart rate and increase the training load when the user's heart rate is lower than the target value or reduce the training load when the user's heart rate exceeds his or her maximum heart rate automatically. This not only ensures user safety during training but also keeps user training in his or her fat burning zone. With this smart function, Babybot can also help to reduce the workload of the staff at different facilities and thus enhance the service quality.

Average MHR Maximum Heart Rate = 220 - age

Low intensity <50% MHR	Moderate intensity 50-70% MHR	Vigorous intensity 70-85% MHR	Extreme intensity >85% MHR
Non effective exercise	Good for exercise beginners	Best fat burning efficiency	May cause heart irregularity

Effective & Safe Training

Ref: American Heart Association

Fig: Relationship between heartrate and training

Brand-new Touring Experience brought by Intel® processors and 5G network

Netown believes the wellbeing of human being is based on both physical and mental aspects," emphasized by Yen-Shan Lin, "And that is why I chose the Taipei Expo Park, which has 70,000m² area, for Netown's Research and Development Center to be located in. At here, we think about, develop, and provide all kinds of services about human wellbeing from physical training, nutrition to lifestyle experience".

In the process of creating its total wellbeing services, Netown has always kept the elderly's needs in mind. Through observation and interviewing, Netown found that the elderly enjoys getting new information while being accompanied by people with similar interests, especially for those who are with moving difficulty. Based on the fact that keep learning and having social interaction are crucial for the improvement of the happiness and meaning of life for the elderly, Netown looks into creating a new style of tourism in the Taipei Expo Park for every elder to be able to explore and experience the park by using the smart wheelchair service.

To create a smart and elderly-friendly wheelchair, Netown adopted Intel® processors for controlling its multiple functions including positioning, virtual tour guide, danger zone detection. The positioning function can identify the user's real-time location and show it on an interaction map. The virtual tour guide will play corresponding introduction videos automatically when the user reaches the tourist attractions in the park and will record the user's video watch history to further offer contents about other attractions based on the user's interest. To ensure the user's safety, smart wheelchair will compulsorily stop when the user gets close to the
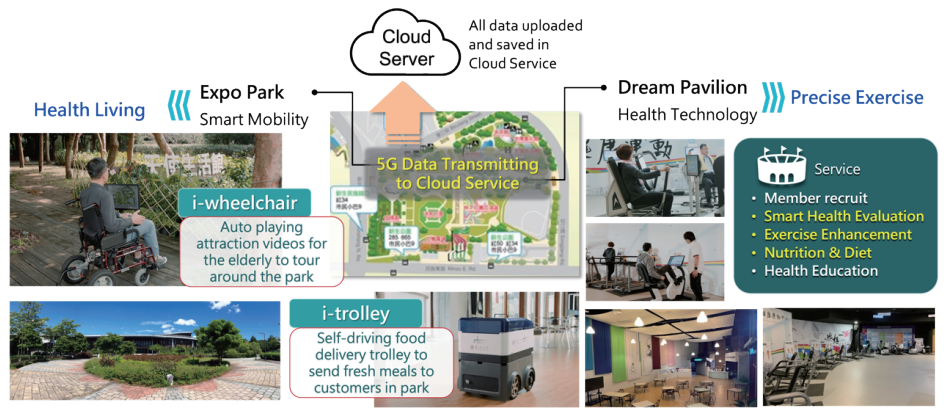

Fig: Service scenario of smart mobility service by using Intel technologies

danger zones, such as ponds.

Apart from powerful CPU brought by Intel, thehigh speed 5G network that fully covers health park region is another key factor to make these service available for its high transmitting speed, high bandwidth, and low latency characteristic.

With all these functions, a user of the smart wheelchair can go to any site which they want to in the park, get new information they are interested in, make reservation for shows or courses they like, and make new friends with the same interests. The smart wheelchair service can be adopted and operated in any other closed zone with customized contents to provide new experience and excitation for the elderly.

Besides the smart wheelchair, Netown also develops the smart trolley for the automatic delivery of meals to users wherever in the park. This service takes advantages of high processing power of Intel® processors and high speed 5G network to detect the positions of the trolley and the user in real-time, and to find an ideal route to deliver the meal. The smart trolley can be adopted in healthcare facilities to support routine works including the delivery of meals and daily supplies to save manpower.

High satisfaction and new opportunities for the smart health enhancement services driven by Intel technologies

The management department of one of Netown's customer, Taipei City Haoran Senior Citizens Home, benefits by providing its residents, particularly those who have higher sarcopenia risk, with Babybot health enhancement system for them to conduct proper training every day. The management department can easily check improvement progress of the resident by viewing the quantitative data analysis results directly generated by the system.

With the application of Intel technology, Netown is now expanding its business to a new market segment of gyms and fitness centers to help facility owners to build professional fitness training programs for the elderly. Meanwhile, Netown is also extending its business model from B2B to B2C. By the advantages of co-branding strategy with Intel, Netown can now promote Babybot to customers as an effective and reliable smart health enhancement solution that the elderly needs.

"The reputation of Babybot is built on the innovation and expertise that Netown has worked on for over 19 years. With the adoption of Intel technologies, Babybot will obtain more satisfaction as the most reliable and comprehensive integrated smart solution for providing the best health enhancement services for the elderly. We are looking forward to the continuous and close collaboration with Intel, which may help us to discover more possibilities in the smart healthcare industry." said Yen-Shan Lin.
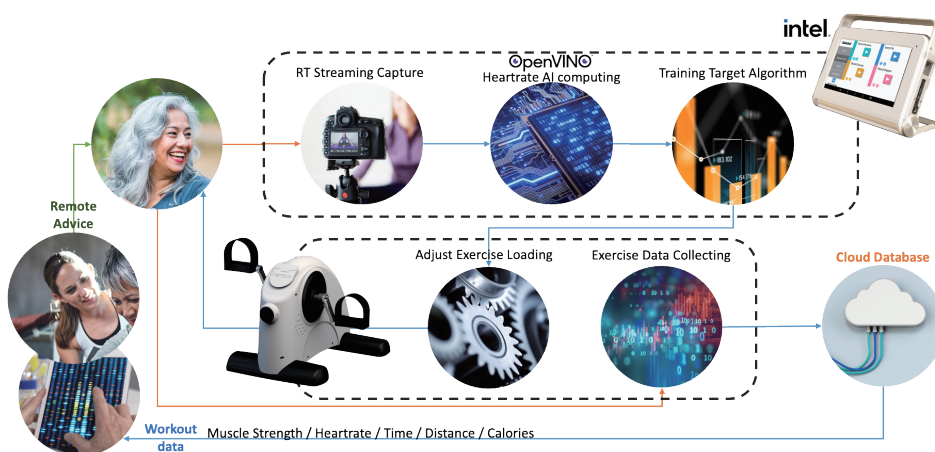

Fig: System architecture of how AI Smart Heartrate Safeguard works with smart training machine