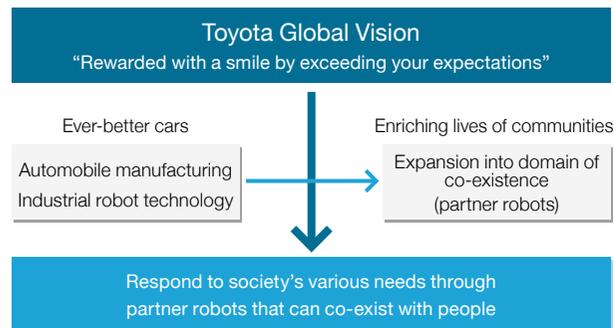


### Partner Robots

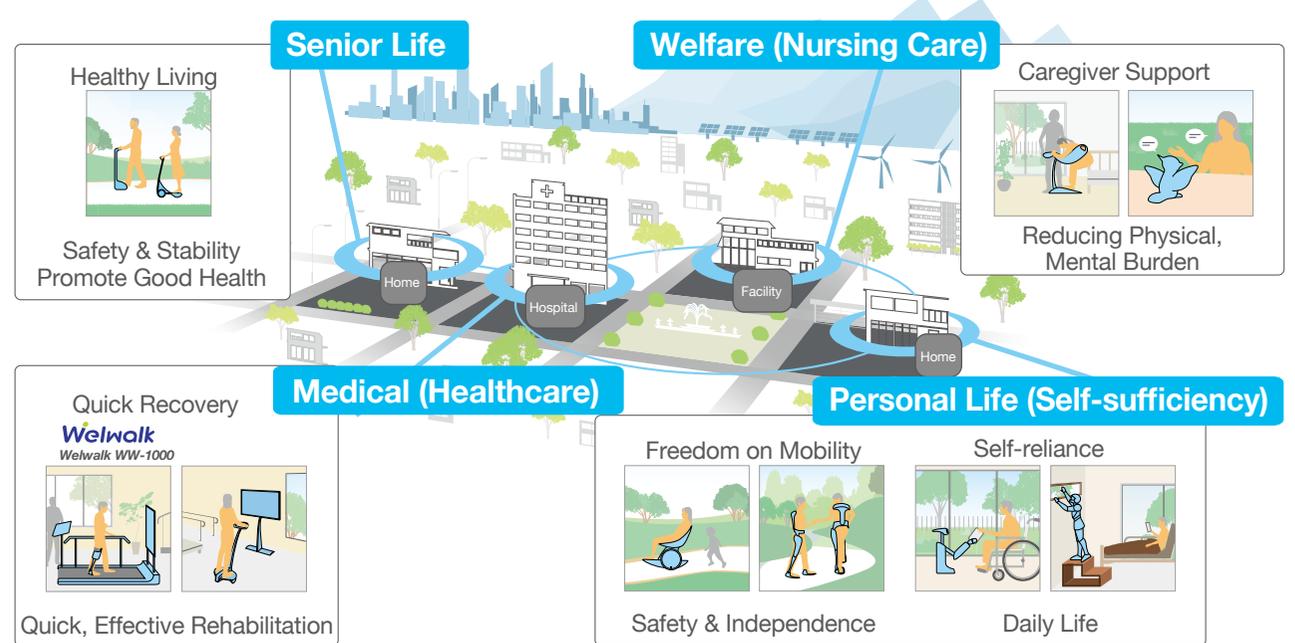
Toyota is responding to social needs by developing human-assisting partner robots that co-exist with people and support their lives.

Toyota is working towards the practical use of partner robots pursuant to a vision based on a concept of “MOBILITY FOR ALL (with the joy of self-reliance)” with four fields of support: senior life, medical (healthcare), personal life (independence), and welfare (nursing care). By providing robots that support the self-reliance of elderly or disabled persons as well as by reducing the burdens on their caregivers, we can respond to the needs of future society with a low birth rate and an aging population. Toyota is contributing to the development of a sustainable society and the realization of comfortable lifestyles for all people.

#### Partner Robot Development Concept



## Aiming for a Society Where All People Can Live Healthy and Happy



#### Schedule and Status of Development for Practical Application

	2018	Around 2020	Field
Walk Training Assist	Approved as a medical device in November 2016. Rental of the Welwalk WW-1000 rehabilitation support robot began in the autumn of 2017.		Senior Life Medical
Social Robots		To both improve lifestyle functions for the elderly and relieve the burden on caretakers, we are developing and testing robots for early introduction.	Personal Life Welfare
Stand-and-ride Personal Mobility		We are conducting repeated demonstration tests through hands on events at commercial facilities, on public roads, and other locations. We plan to expand use by cooperating with police and government.	Senior Life
Balance Training Assist		These robots were introduced at 21 healthcare institutions located nationwide for clinical research. We are working towards practical application based on <i>genchi genbutsu</i> (onsite hands-on experience) and feedback from physicians and physical therapists.	Medical
Human Support Robot (HSR)		Toyota is creating a development community through open innovation and accelerating technology development and verification trials for practical application.	Personal Life

Development Verification Commercialization

### Welwalk WW-1000 Rehabilitation Assist Robot

The Welwalk WW-1000 is designed to support rehabilitation such as walking training for people with lower limb paralysis due to strokes, etc. It features a range of rehabilitation support functions based on exercise learning theory, including an assistance adjustment function to set the level according to the patient, and to provide feedback regarding the patient's gait characteristics. The robot's simple construction and functions, such as easy fitting and central touch panel operation, ensure easy use in clinical settings.

Development of rehabilitation robots in the medical support field began at the end of 2007 with the collaboration of Fujita Health University in Toyoake City, Aichi Prefecture. Verification testing has been conducted at medical facilities since 2011. Between 2014 and the end of March 2018, Walk Training Assist robots have been installed in 23 medical facilities throughout Japan for clinical research. In 2016, it obtained approval as a medical device, and from May 2017, we began a rental business aimed at medical institutions, with the goal of having 100 in place. We worked with companies that have strong sales and services in the medical field, and by September 2017 we had supplied products to hospitals and other places. In addition, our website provides the latest information regarding the Welwalk WW-1000 to medical professionals.



Welwalk WW-1000 website



### Development of Winglet Personal Mobility Robot

Toyota is developing Winglet, a personal mobility robot that supports human mobility and makes daily activities more convenient. It is a form of mobility that makes it possible to travel seamlessly from inside commercial facilities and other indoor locations to outdoors. Through verification tests designed to assess the robot's safety and convenience, and to encourage its commercialization, we have expanded opportunities for people to experience Winglet.



Winglet (Type L)

### Development of Pocobee Social Robot

We are involved in the development of social robots to support self-sufficient lifestyles for the elderly and helping support caregivers.

To respond to the increase in dementia patients, Pocobee is a robot to prevent and curtail the progression of dementia and contribute to reducing the burdens on caregivers. Verification tests began in 2016 at the National Center for Geriatrics and Gerontology.

To prevent illnesses such as dementia, it is important to maintain health. To that end, we are enhancing functions that provide target-oriented encouragement to increase what can be done according to person's ability not just increasing what is done normally. As a result, we hope to be able to link this to improved roles (social participation) in society or at home.

By linking caregivers and robots, we hope to safely increase the activities of the elderly and improve their lifestyle functions, as well as contribute to alleviating the burdens of caregivers.



Pocobee

### Expanding the Development Community through Supplying HSRs (Human Support Robots)

The Human Support Robot (HSR) is intended to provide a wide range of support including assistance, self-sufficiency, and household tasks. In addition to fundamental tasks such as picking up, carrying, and handing over objects, we are conducting development towards application in preventive health care and health management and are conducting repeated verification trials in senior facilities and households with disabled persons.

On the other hand, work items expected of HSRs from these verifications are very diverse in both quality and quantity. Therefore, starting in 2015, we have supplied HSRs to universities and research institutes as platforms, forming a development community that promotes sharing results and mutual use. In 2016, a joint university team won the technical innovation award at the RoboCup@Home international competition. From the 2017 RoboCup in Nagoya, we have been supplying HSRs as the standard platform for this competition. It is decided to provide HSRs for the platform in the household task support event at the 2020 World Robot Summit. In this way, we are working to accelerate development through open innovation.



HSR (Human Support Robot)

### Announcement of the Third-generation Humanoid Robot, T-HR3, Combining Cleverness with Gentleness

In November 2017, Toyota developed and announced the T-HR3 Humanoid Robot, a robot whose entire body can move smoothly through links with the movements of a remote operator.

The T-HR3 is a bipedal “partner robot” suited for living environments. The operator can operate the robot instinctively, with fine movements of the hands and arms. This allows it to walk like a human, while still retaining its balance. The first and second generation humanoid robots, announced in the past, were

able to play musical instruments, but needed precise program-based position control for their finger movements. In contrast, the T-HR3 allows for flexible control of the joints. Our aim is for it to safely work alongside humans in a range of scenarios, including the home and medical institutions, acting as a partner robot that gently supports lifestyles. And, in the future, we will move



T-HR3 humanoid robot

beyond the home and medical institutions, including the development of robots that can work in disaster sites, construction work, and even space within our sights.

### Robotic Smart Home Project—Aiming to Provide Comfortable, Reassuring Home Lives for the Elderly

To achieve comfortable, reassuring home lives for the elderly, we need comprehensive space design and verification for a range of support devices that includes support robots and communication devices, home devices, and IoT devices.

In September 2017, Toyota started the RSH Project jointly with 14 other companies and institutes in a test site (model room) that replicates a 75 m<sup>2</sup> living space, constructed in the Toyoake Apartment Complex, Toyoake City, Aichi Prefecture.

Eleven of these companies and institutes taking part, starting with Toyota, are also participating in the Knowledge Hub Aichi Key Research Project (Phase II) that supports the introduction of household devices and IoT devices, their verification and operation, and the commercialization of developed devices.

By promoting robots and IoT, Toyota will continue to develop and verify robots and living spaces. We will work to develop functions that make more comfortable and reassuring homes.



Inside the model room

