Tune

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Tohoku University Research News of Engineering

Robotics, Today & Tomorrow

World Formation Envisioned

Graduate School of Engineering, Tohoku University
Professor
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Ranking & Data
TOHOKU UNIVERSITY

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Text by Stophe POMEROY / Photographs by Hayato IKEGAMI

Hirata Yasuhisa, Professor,
Department of Robotics,
Graduate School of Engineering, Tohoku University

1998 Bachelor's Degree, 2000 Master's Degree, and 2004 Ph.D., Tohoku University; 2000-2006 Research Associate, 2006-2016 Associate Professor, and 2016- Professor, Tohoku University; 2020- Project Manager of The Moonshot Research and Development Program, JST; 2016- IEEE Robotics & Automation Society Associate VP for Technical Activities Board, 2016- Co-Chairs of IEEE RSA TC on Rehabilitation and Assistive Robotics, and 2020- IEEE Robotics & Automation Society AdCom Member.

IoT and Haptics, "Simple" yet "Tinkerable"

What is Moonshot?

Stophe Pomeroy (SP): *Dr. Hirata, I understand you set up the Smart Robots Design Lab because you believe that appropriate design alters the acceptability of advanced technology by society?*

Dr. Hirata (HY): Yes. The design of a robot includes the design of its hardware as well as that of the software for controlling the movements in its entirety. I believe robots should have a shape and form fitting comfortably into society, while also behaving appropriately to support humans. In order to achieve this, we need to conduct interdisciplinary research not only in terms of engineering, but also with various researchers in psychology, sociology, ethics and law, matching the needs of modern times.

SP: *What is your current area of specific research interest?*

HY: I am particularly focused on Passive Robotics. Basically, it involves using passive elements like braking mechanisms. Unlike motor-driven and thus, if gone awry, potentially dangerous devices, it is the human, the individual, taking the initiative... not a powerful and unfeeling actuator making the body move. Speaking of "beyond" I look past human-robot interaction [although ergonomics is central to user-friendliness] from the passive robotics stance to note that my research encourages humans to move actively in the field, from object handling to human guidance/sports coaching, all the while enabling higher safety generally along with lower costs.

SP: *Yes, indeed matching the needs of our times - and truly, time flies like an arrow. Before we noticed, ten years have passed since the 2011 disaster and before we know, the next world expo will again be hosted by Japan to showcase our changed world. Many drastic changes ahead... .*

HY: Talking of global showcases I think our Lab can be equated to a global showcase, an international as well as intercultural endeavor with participants from the world over working at the cutting edge of research, in addition to the color added by the unique team we have assembled here. As for myself I hope to concentrate on robot systems interface with humans in a real setting, plus robot interaction/cooperation, not to mention assistive robotics technology. We do have a cross-section of the globe here, with my colleagues covering wide-ranging areas including ethical and socioeconomic concerns, and we are well attuned to major changes at the international level.

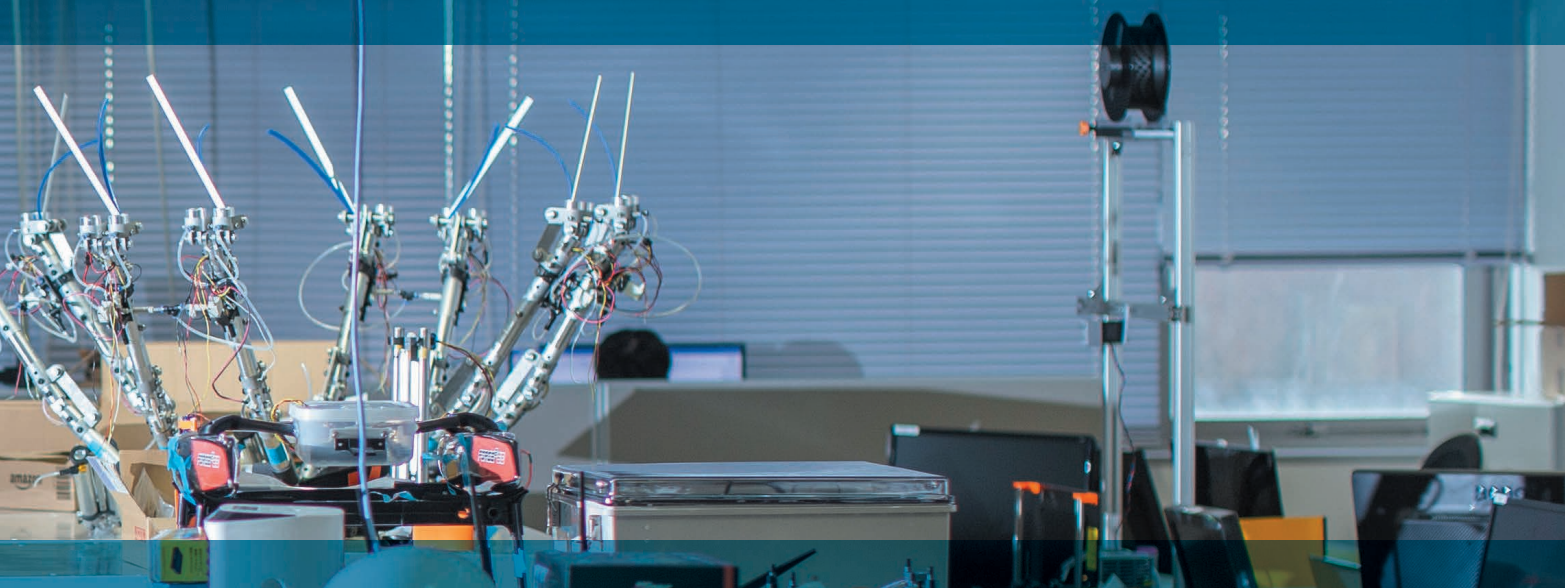
IoT and Haptics

SP: *You mention that your research is applicable to sports coaching and such... can you tell us more?*

HY: Technology such as the Internet of Things (IoT) combined with advances in the haptics and sensing sector will enable coordinated activities to yield better results. The sports coaching system analyzes the motions of multiple sports players detected by IoT sensing device, then the haptic device attached to sports players conveys appropriate motion direction and moving distance, along with speed, to the players simultaneously. Sensing technology improvements have also pushed forward our endeavor, without complicating the overall scheme of things.

Japan is known as a future-oriented country with propensity for adopting robots ahead of rest of the world; as such it today still continues to challenge forward-looking projects related to technology. In line with images shown in comics/Anime and SciFi movies, a plethora of mechanical equipment which remind of robots, from factory automation to sentry drones, can be found almost everywhere on the island nation. The academic discipline of robotics as a scientific pursuit of realizing practical robots is said to have started in the 1950s, although the idea of human-like "appliances" made to serve humans physically was originated in ancient Greece as well as in China. The concept of non-human "laborers" gained global currency thanks to Czech playwright Karel Capek's 1920 science fiction, wherein the term "robot" was coined, then was followed up by the manifestation depicted in Fritz Lang's movie "Metropolis." However it was Osamu Tezuka's "Astroboy" TV show which turned Japan into a major powerhouse in terms of robots, having the aim of assisting and even rescuing people. Today, robotics is a major academic field, as borne out by mechatronic devices being realized at Tohoku University.

It is not an exaggeration to say that the Tohoku University robots design lab located in Sendai are particularly at the leading edge. The work of Professor Yasuhisa Hirata upon which we herewith focus offers an example of interfacing not just for robots and humans but with the environment and nature as well.



Simplicity

SP: *Yes, "Simple Is Best" as the saying goes - in line with Occam's Razor, it leads to simple elegance rather than a waste-of-space Rube Goldberg contraption.*

HY: Indeed, it is better to interact with the environs via straightforward robotic schemes, in using as simple yet elegant means as possible. We therefore need to delve further into advanced application of haptics, along with cognition as to visual and other senses, to our set-ups. Thus the cooperation with social scientists and psychology/cognitive science experts.

Tinkerings

SP: *I see also your researchers are tinkering with existing products to upgrade them for assistive purposes while arranging parts via three-dimensional printers for use upon adapting conventional items.*

HY: Yes, thanks to 3D printers, we can quickly make and test what we want to make, which speeds up the development of our robots. Recently, we have also been working on building our own new 3D printer to make lighter and more rigid parts.

Moonshot

SP: *Thank you for your great answers! Finally, any other message for those TUNEd in here?*

HY: I am now Project Manager for "Adaptable Artificial Intelligence (AI)-enabled Robots to Create a Vibrant Society" theme under the Moonshot* Goal 3 of Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050. This project aims at creating a collective of adaptable AI-enabled robots available at a variety of places, with each robot being always usable by anyone while adjusting its form and functions according to the individual user, to provide optimal assistance and services. By 2050 we hope to see a wide variety of robots and people in co-existence/co-evolution to create a vibrant society in which all people participate.

* The Moonshot Research and Development (R&D) Program run by the Japanese Cabinet Office sets high-impact R&D Goals for realizing solutions to issues facing future society, such as super-aging populations and global warming.

The Cycling Wheelchair (CW) is a pedal-driven wheelchair enabling even people who have lower limb disabilities to move it with their own leg strength. By controlling the brake and the Continuous Variable Transmission (CVT) attached to the wheels, we have realized many assistive functions. This wheelchair was demonstrated at the Honolulu Marathon several years ago.

Ranking & Data

TOHOKU UNIVERSITY

University Ranking

79

QS QS World University Rankings 2021

23 **QS Asia** QS Asia University Rankings 2021

61 **Reuters Top 100:** The World's Most Innovative Universities 2019

1 **THE** Japan University Rankings 2020

QS QS World University Rankings by Subject 2021

Engineering

Engineering - Mechanical

Engineering - Chemical

ARWU ShanghaiRanking's Global Ranking of Academic Subjects 2020

Metallurgical Engineering

Aerospace Engineering

Researcher Datebase http://.db.tohoku.ac.jp/whois/TunvTopE.html

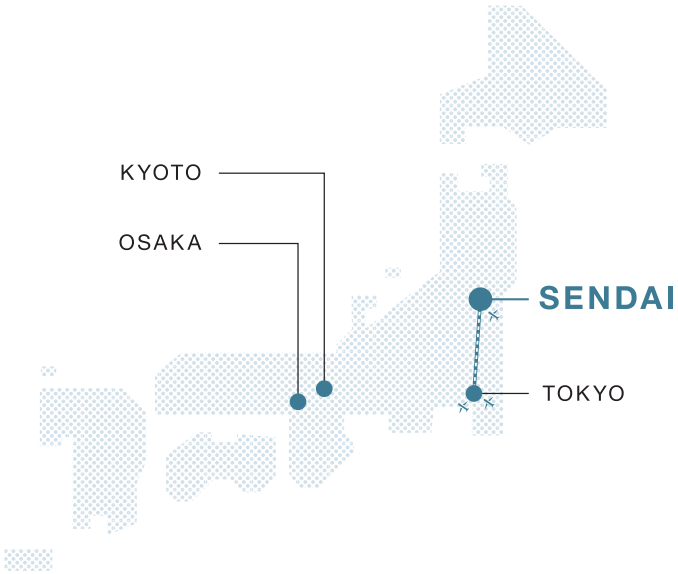
Statistics 2020

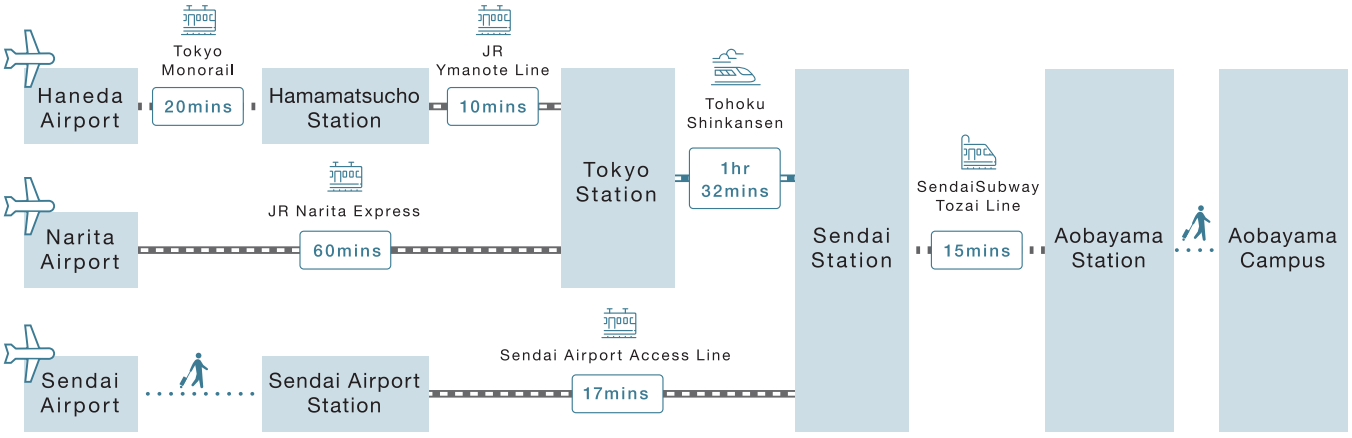
	Tohoku University	School of Engineering
STUDENTS-TO-FACULTY RATIO	1 : 6	1 : 9
NUMBER OF FACULTY	3,219	642
NUMBER OF INTERNATIONAL STUDENTS	2,081	579
UNDERGRADS	10,731	3,464
GRAD STUDENTS (MS)	4,410	1,548
GRAD STUDENTS (PhD)	2,655	498

Sendai, the home city of Tohoku University

SENDAI At a Glance

Average Temp.	12 ℃
Precipitation	1241 mm
Sunshine	1843 hours





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