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Satoshi Tadokoro
Editor

Disaster Robotics

Results from the ImPACT Tough Robotics
Challenge

 Springer

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To the victims of disasters

Preface

The ImPACT Tough Robotics Challenge (ImPACT-TRC) is a national project funded by the Japan Cabinet Office from 2014 to 2018. It focuses on research and development of robot technologies for emergency response, disaster recovery, and damage prevention. This book introduces the major outcomes of this project.

Japan experienced enormous damage from the Great East Japan Earthquake and the subsequent Fukushima Daiichi Nuclear Power Plant accident in 2011. ImPACT-TRC organized a Field Evaluation Forum which brought together more than 500 participants in one of the stricken cities, Minami-Soma City, on June 14, 2018. The city has not yet recovered from the damage. An old chef from the restaurant where I had dinner told me, “My children and grandchildren would never come back. My family has been separated. I cannot expect the small happiness of my family anymore.”

In 2011, I donated three units of an unmanned ground vehicle called Quince to the Tokyo Electric Power Company for investigation in the nuclear reactor buildings of the Fukushima Daiichi as the first national robot used there. Quince was being developed by a consortium of Tohoku University, the Chiba Institute of Technology (CIT), and the International Rescue System Institute (IRS) in a project funded by the New Energy and Industrial Technology Development Organization (NEDO). The decision of the donation was based on the fear that the reactors would not be stabilized and the contamination might spread further. “If that would become the case, we would not be able to live in Sendai, which is situated 100 km from the plant, and possibly in Tokyo or potentially all over Japan,” the team members considered. The original target of Quince was completely independent from such nuclear accidents, and we did not have any duty on this mission apparently. I really thank Prof. Eiji Koyanagi and Dr. Seiga Kiribayashi, who worked at CIT at that time, and Profs. Keiji Nagatani, Kazunori Ohno, and Yoshito Okada of Tohoku University, for their devoted contribution.

I started researching into rescue robotics in 1995 when I experienced the Great Hanshin-Awaji Earthquake. Mr. Satoshi Fuji, who was a student of mine at Kobe University, was buried under his house and was rescued after four hours. The doctor initially told his parents, “He suffers from crush syndrome, and has no

chance of survival. You have to give up.” He is lucky that he is still alive. Mr. Motohiro Kiso, a student of Prof. Fumitoshi Matsuno, passed away under the debris. An American football player in the Kobe University team found a young lady after hearing her voice from under a floor. He removed the tatami mats and the planks from the wooden floor plates again and again, and finally found her. He tried to drag her body out from the debris but he could not, despite his strength, because her leg was trapped. A fire broke out and began to spread to his house. She asked him to cut off her leg to save her, but he was unable to do so, and he was forced to flee from the fire. “I left her to die...,” he said. His voice has been echoing in my mind periodically since then.

When I led the DDT Project of the Japan Ministry of Education, young firefighters in the Kobe Fire Department came to the Kobe Laboratory of the International Rescue System Institute in 2003 to learn about rescue robots. I remember our heated discussion on how robots can help search and rescue in the future, what is needed, the conditions at disaster sites, the firefighters’ mission, and so on. A few weeks later, I watched a TV news story reporting that four firefighters had died in Kobe when a burning roof caved in on them. I was surprised to see their names. One of the four was a firefighter whom I had met at the laboratory. I still remember his young wife weeping as she held a newborn baby at his funeral.

What is our most important value for us? My personal opinion: human life.

The mission of the ImPACT-TRC is to develop technologies for saving lives and minimizing the damages from disasters for the safety and security of humanity. As the program manager, I am delighted to see that this 5-year project has produced various world’s firsts, world’s bests, and world-class technical innovations. At the same time, it is producing social and industrial innovations.

The research members have compiled overviews of the technical and scientific results into this book. I recommend the readers to explore the original papers listed in the references for more details.

I especially want to thank the researchers who have been collaborating together to produce such excellent outcomes. The contributions of the Japan Cabinet Office, the Japan Science and Technology Agency, the International Rescue System Institute, Tohoku University, and other participating persons and organizations have been significant.

Hoping for more safety and security supported by robotics.

Sendai, Japan
October 2018

Satoshi Tadokoro
Professor, Tohoku University
President, International Rescue System Institute
Program Manager, ImPACT Tough Robotics Challenge

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