Editorial

Special Issue on the Fourth International Conference on Field and Service Robotics, 2003

Since the first International Conference on Field and Service Robotics (FSR), which was held in Canberra, Australia, 1997, and organized by Prof. Alexander Zelinsky, much attention has been increasingly paid to the technology of field and service robotics. The FSR conferences have been held bi-annually since: FSR ’99, Pittsburgh, USA, FSR’01, Helsinki, Finland, and FSR’03, Yamanashi, Japan. This special issue is a collection of selected papers from FSR’03.

To promote the robot industry, the potential needs and the market of robot technology have been investigated, and it has been predicted that field and service robots is the area most expected to enlarge the robot market rather than manufacturing. At FSR conferences, many exciting cutting-edge technologies have been introduced and discussed, and from this was proposed the probabilistic approach represented by SLAM (Simultaneous Localization and Mapping), which dramatically made solvable the localization and mapping issues in real environments. This technology is extensive, not only in robot science, but also in robot applications. Furthermore, the evolution in sensing technologies and infrastructures for robot navigation, such as laser range sensors, GPS, etc. have made great contribution to the localization, mapping, and navigation. Since the first FSR conference was held, great progress has been achieved in field and service robotics, and the available technology which has evolved has made feasible the introduction of mobile robots and vehicles to various actual applications.

In addition, conventional research on mechanical design, perception, planning, and control as well as learning has also grown in these years. An intensive effort was made to accommodate to uncertainty and complexity in the environment, even in the human co-existent environment. Realization of the adaptive function of robots has been pursued. It should also be noted that attention has been increasingly paid to the services which can be delivered by robot technology rather than the function of the robot itself.

Sixty-eight papers were submitted to FSR’03, and 49 original papers were selected for presentation based on the outcome of a strict review process by the program committee members. The contents of the papers presented at FSR’03 are very interesting. All the presented papers will be published as a monograph book of the STAR series from Springer, which is entitled “Field and Service Robotics: Recent Advances in Research and Applications.” For this special issue we selected 11 papers which were rated very highly by the reviewers. The authors of these invited papers were requested to submit revised and extended versions from those of the proceedings papers, and also to include some up-to-date results. All the papers were subjected to the IJRR normal review process, after which six papers were finally accepted for publication of IJRR, and are included in this volume.

Three papers are concerned with vehicle localization, mapping, and navigation:

Huber and Vandapel proposed automatic 3D modeling-from-reality algorithms, which were successfully applied to the problem of mapping of underground mines. A high-resolution 3D model was obtained. The order of 1[cm] geometric error was estimated to be achieved with the model which was constructed during field tests. Coué, Pradalier, Laugier, Fraichard and Bessière addressed a new approach for robust perception and risk assessment in highly dynamic environments. This approach is called Bayesian Occupancy Filtering; it basically combines a 4-dimensional occupancy grid representation of the obstacle state-space with Bayesian filtering techniques. Vandapel, Donamukkala and Herbert presented algorithms which exploit aerial ladar data for autonomous ground vehicle navigation for the localization of a robot, and for assistance of the vehicle planning global paths. The proposed algorithms have been successfully tested in actual missions in different types of terrains.

The paper by Petersson, Fletcher, Barnes, Arnell and Zelinsky is related to a driver assistance system, and presents a framework for interactive driver assistance systems (DAS). A number of different sensing components were presented of which obstacle detection and tracking together with speed sign detection were investigated in detail. A speed sign DAS, which uses the speed sign detection component combined with a driver gaze monitoring system, was presented as an example.

Zlot and Stenz discuss the task allocation problem in multi-robot coordination, they introduce a new method for distributing task allocation and planning over a team of robots.
robots, which incorporates hierarchical planning directly within a market-based multi-robot coordination approach. A successful implementation of the task tree market approach on two physical robot teams performing area reconnaissance missions in both indoor and outdoor environments was demonstrated.

The paper by Mishima, Aoki and Hirose is concerned with the mechanical design of field and service robots, and reports on the mechanical design of pneumatic-drive expandable arm “Slime Scope”, which has a search device, such as CCD camera, at the end of the pneumatically controlled expandable arm. That can drive stably in a rough terrain environment where neither electric power nor wireless communication is available.

FSR ’05 was held in Port Douglas, Australia, where again many interesting papers were presented, and also there were active discussions on most advanced topics. FSR ’07 is planned to be held in Switzerland.

Finally, we express our great gratitude to those who served as reviewers, and therefore helped to make the papers of a high quality.

Hajime Asama
RACE, The University of Tokyo, Japan

Erwin Prassler
Bonn-Aachen International Center for Information Technology, Germany

Sebastian Thrun
Stanford University, USA

Alexander Zelinsky
CSIRO ICT Centre, Australia

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Hajime Asama was born on Jan. 18, 1959. He received MS and DS degrees in Engineering from the University of Tokyo, in 1984 and 1989, respectively. He worked at RIKEN (The Institute of Physical and Chemical Research, Japan) from 1986 to 2002, and became the professor of RACE (Research into Artifacts, Center for Engineering), the University of Tokyo in 2002. He received JSME Robotics and Mechatronics Division Robotics and Mechatronics Award in 1995, JSME Robotics and Mechatronics Division Robotics and Mechatronics Academic Achievement Award in 2000, etc. He was an editor of the first, second and fifth volumes of the “Distributed Autonomous Robotics Systems” Series, published by Springer-Verlag, Tokyo, in 1994, 1996 and 2002 respectively. He has been a fellow of JSME since 2004, and a member of IEEE, IEEJ, RSJ, and SICE. His main interests are distributed autonomous robotic systems, cooperation of multiple autonomous mobile robots, emergent robotic systems, intelligent data carrier systems, and service engineering.

Dr Erwin Prassler received a master’s degree in Computer Science from the Technical University of Munich in 1985 and a Ph.D. in Computer Science from the University of Ulm in March 1996. For his doctoral dissertation he received the AKI dissertation award in September 1997. Between 1986 and 1989, Dr Prassler held positions as a member of the scientific staff at the Technical University of Munich and as a guest researcher in the Computer Science Department at the University of Toronto. In autumn 1989, he joined the Research Institute for Applied Knowledge Processing (FAW) in Ulm, where he headed a research group working in the field of mobile robots and service robotics between 1994 and 2003. In 1999, Dr Prassler entered a joint affiliation with Gesellschaft fur Produktionssysteme (GPS) in Stuttgart, where he has been directing the department for Project Management and Technology Transfer. In this function, Dr Prassler coordinated the MORPHA project (Interaction and Communication between Humans and Intelligent Robot Assistants, www.morpha.de) one of six national
research projects in the field of Human Machine Interaction funded by the German Ministry for Education and Research. In March 2004, Dr Prassler was appointed as an Associate Professor at the Bonn-Aachen International Center for Information Technology, which is a joint institution between the Univ. of Bonn, the Univ. of Applied Science in Bonn-Rhein-Sieg and RWTH Aachen.

Sebastian Thrun is Associate Professor of Computer Science and Director of the Stanford Artificial Intelligence Laboratory (SAIL). Thrun won the DARPA Grand Challenge, published seven books, nearly 300 refereed papers, won numerous best paper awards, and served as PI on 6 major DARPA initiatives. Thrun’s research focuses on robotics, machine learning, and artificial intelligence.

In July 2004 Dr Alex Zelinsky joined CSIRO as Director of the Information and Communications Technology (ICT) Centre. With 200 research professionals the Centre is responsible for conducting ICT research for both community-good and commercial benefit. Prior to joining CSIRO, Dr Zelinsky was the CEO and founder of Seeing Machines Limited (2000-2004), a company recognised as a world leader in applied computer vision systems. The company is publicly listed on the London Stock Exchange. Before Dr. Zelinsky co-founded Seeing Machines in July 2000, he was Professor and Head of the Department of Systems Engineering, Research School of Information Sciences & Engineering at the Australian National University. Dr. Zelinsky is extensively published and is internationally recognised as a leader in the fields of Robotics and Computer Vision. He has a strong interest in field and service robotics, and has been responsible for organising the Field & Service Robotics (FSR) conference series commencing in 1997. Dr. Zelinsky is an Editorial Board member of International Journal of Robotics Research, IEEE Robotics and Automation Magazine, and IEEE Trans on Intelligent Transportation Systems. Dr. Zelinsky has received numerous awards for his work, including in 2003-2005 he was selected as a Technology Pioneer by the World Economic Forum. He is a Fellow of the Australian Academy of Technological Sciences and Engineering.