Triennial Review Report for Technical Committee on Networked Robots

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The technical committee (TC) on networked robots was originally found as the online robots TC in 2001 and transformed into the TC on networked robots in 2004. The focus of the TC has been broadened into two directions: networked teleoperation and sensor/robot network.

Assessment of the TC

The current three co-chairs took over the TC in 2007. The TC has witnessed significant development and growth in past three years. We have seen the widely-accepted notion that robots and networks are integral parts of modern intelligent systems. The importance of the area becomes more evident as time goes. One indicator is the fact that the networked robots area now becomes the infrastructure for new research domains such as swarm intelligence, formation control, etc.   As an honest assessment, all co-chairs firmly believe that the area still has great potential for future development. The area still needs the guidance of the TC to focus its efforts to address both fundamental problems and novel applications that benefits the society. Therefore, we believe it is necessary to keep the technical committee at least for another three year to provide a community for researchers in the area.

TC Activities in Past Three Years

The TC has been very active in past three years. The activities are,

1)   Online activities

Under the joint effort of ex-co-chairs and co-chairs, the TC has transformed from a list of people to a community for the researchers in the area. We have maintained a TC web page at,

http://faculty.cs.tamu.edu/dzsong/tc/index.html.

We have updated the technical activity database (http://tab.ieee-ras.org/committeeinfo.php?tcid=15) regularly.

Moreover, we have established a google group page for the TC,

 http://groups.google.com/group/networked-robots

It provides an email list for us to regularly organize research activities. We also enlist labs and projects that relate to the TC and form a research portal page,

http://groups.google.com/group/networked-robots/web.

This research portal provides a great entry point for those who are interested in the area.

2) Workshop organization

   i. <u>Collaborative Field Trial on Network Robot Systems between EU and Japan</u>, Testbed January 28 and 29, 2009 - Osaka, Japan, Organized by Norihiro Hagit(ATR) and Paolo Dario (SSSA) http://www.dustbot.org/index.php?menu=osaka

   ii. <u>Workshop on Network Robot Systems: Human Concepts of Space and Activity, Integration and Applications Workshop,</u> September 26, 2008 - Nice, France Organized by Norihiro Hagita (ATR), Alberto Sanfeliu (Technical Univ. of Catalonia), Young-Jo Cho (ETRI), Hiroshi Ishiguro (Osaka Univ.), Ben Krose(Univ. of Amsterdam), Zoran Zivkovic(NXP Semiconductor Research), and Hideki Hashimoto(Univ. of Tokyo) IEEE/RSJ International Conference on Intelligent Robots and Systems, Nice, France September 26, 2008 http://www.science.uva.nl/research/ias/FS2HSC/workshops/IROS2008/index.html

   iii. <u>Workshop on Network Robot Systems: Benchmarks and Platforms toward Human-Robot Interaction,</u> May 19, 2008 Norihiro Hagita (ATR), Alberto Sanfeliu (Technical University of Catalonia), Tomomasa Sato (University of Tokyo) and Hiroshi Ishiguro (Osaka University) IEEE International Conference on Robotics and Automation, Pasadena May 19, 2008 http://www.irc.atr.jp/icra08_nrs_workshop/

   iv. <u>The 3th Korea-Japan Joint Symposium on Network Robot Systems Symposium,</u> November 23, 2007 Organized by KAIRA (Korea Advanced Intelligent Robot Association) and Japan Network Robot Forum(NRF) Pohang, Korea

   v. <u>Workshop on Network Robot System: Ubiquitous, Cooperative, Interactive Robots for Human Robot Symbiosis Workshop,</u> October 29, 2007 Organized by Norihiro Hagita (ATR), Alberto Sanfeliu (Technical University of Catalonia), Young-Jo Cho (ETRI), Hiroshi Ishiguro (Osaka University), Klaus Schilling (Julius-Maximilians-University Wurzburg), and Dezhen Song (Texas A&M University) IEEE/RSJ International Conference on Intelligent Robots and Systems, San Diego, U.S.A. October 29, 2007, http://www.irc.atr.jp/iros07_nrs_workshop/

   vi. IFAC Workshop on Networked Robotics, October 6-8, 2009, Golden, Colorado USA, Klaus Schilling and Kevin L. Moore, http://control.mines.edu/netrob09/index.html

3) Journal Special Issue

   i) Special Issue on Networked Robots: Serving the Society, Journal of Intelligent Service Robotics,
http://faculty.cs.tamu.edu/dzsong/tc/JISR-special-issue-call.html
Special Issue Editors:
    * Nak Young Chong, School of Information Science, JAIST, Japan
    * Norihiro Hagita, ATR Intelligent Robotics and Communicatuon Laboratories, Japan
    * Volkan Isler, Computer Science Dept., Univ. of Minnesota, USA
    * Klaus Schilling, Computer Science Dept., the University of Würzburg, Germany,
    * Dezhen Song, Computer Science and Engineering Dept., Texas A&M University, USA

   ii) Journal of Robotics and Autonomous Systems
http://www.elsevier.com/wps/find/journaldescription.cws_home/505622/bibliographic

The TC co-chairs have also attended GOLD lunch regularly in each ICRA and IROS conferences to promote the TC.

TC Member Statistics

Since 2007, the TC member number has grows from 197 to 239. It indicates the TC has stabilized its core members and become a steady group of researchers.

Important Publications

Actually, there are many important publications in the area. The TC actually contributed two chapters to the Springer Handbook of Robotics,

D. Song, K. Goldberg, and N. Y. Chong, *Chapter 32: Networked Teleoperation*, Springer Handbook of Robotics, Siciliano, Bruno; Khatib, Oussama (Eds.), Springer, 2008

Vijay Kumar, Daniela Rus, Gaurav Sukhatme, Chap. 41. Networked Robots, Springer Handbook of Robotics, Siciliano, Bruno; Khatib, Oussama (Eds.), Springer, 2008

As new development, there is a new book published in the area

Dezhen Song, *Sharing a Vision: Systems and Algorithms for Collaboratively-Teleoperated Robotic Cameras*, Springer Tracts on Advanced Robotics, Vol. 51, ISBN: 978-3-540-88064-6, 2009, Springer

Expected Innovation in Next Three Years

Networked robots will continue to have societal and academic impacts. The research focuses will be expected to address two main challenges: fundamental problems and novel applications. For fundamental problems, we expect new research would address the problems in foundation of the networked system such as communication, coordination, and planning with realistic constraints. To develop algorithms and theories that can address challenges from real world applications such as unstructured environment, quick deployment, sensor fusion, planning and scheduling, calibration, power and communication constraints, etc. For novel applications, we expect researchers would explore how the networked robots technology can transform areas such as safety and efficiency of manufacturing, improving infrastructure, search and rescue, surveillance, environmental monitoring, medical and health care, etc.

Candidates of New Co-Chairs

Prof. Dezhen Song plans to retire from the co-chair position. He nominates Prof. Volkan Isler to take over the co-chair for North America area. (http://www-users.cs.umn.edu/~isler/)

Dr. Norihiro Hagita will serve for another term.

Prof. Klaus Schilling has not made decision about his co-chair position yet.