POST-CONFERENCE PROCEEDINGS
WORKSHOP SESSION SUMMARY
NIEHS NATIONAL TRAINERS' EXCHANGE
MARCH 2007

1. Session Title and Presenter's Contact Information:

"Improving Disaster Response with Robot and Multi-Touch Technologies."

Mark Micire and Dr. Holly Yanco
University of Massachusetts, Lowell
One University Avenue, Olsen Hall, Room 304
Lowell, MA 01854
Tel: 978-934-3385
E-mail: mmicire@cs.uml.edu and holly@cs.uml.edu

2. Workshop Summary

The response to the World Trade Center was first discussed in the context of robot reconnaissance. The World Trade Center disaster was significant in that, prior to these events, no urban search and rescue response had used robotic technology in the technical search process. The activities performed by the Center for Robot Assisted Search and Rescue in response to this disaster aided in the two week rescue phase after the initial strike. This response guided further research and development of search and rescue systems. Over the next five years, robots slowly found their way into the hands of search and rescue groups. One of the robots at the front of this push is the Inuktun VGTV-Xtreme series by American Standard Robotics. This capable robot is one of the only robots engineered specifically for the search and rescue domain. This talk demonstrated the VGTV platform that was adapted from an industrial inspection robot into a capable and versatile search and rescue robot.

The last part of the presentation discussed the new and innovative use of touch screen technology for command and control of large-scale emergencies. Multi-touch screens may be able to bridge the gap between the unused aerial reconnaissance information and the rescue teams on the ground. Once information on the disaster is registered to a virtual map, the command staff can quickly and interactively assesses the situation. Multiple representatives from multiple agencies can have the convenience of a paper tabletop map while benefiting from the dynamic nature of this digital medium.

3. Methods

The presentation encouraged group discussion on all points, and interactive demonstrations of the VGTV robot and DiamondTouch touch-screen were given.

During the touch screen portion we demonstrated a mock up of our proposed interface. We use an interactive 2D map on the DiamondTouch, which provides a natural interface similar to pen and paper. This very preliminary prototype is significant because multi-touch systems have yet to be used in command and control environments or robot control.

In out implementation, Hurricane Katrina aerial photography of Biloxi, Mississippi is overlaid on pre-disaster satellite imagery. To reveal the post-disaster image, the user places two fingers around the area of interest. This opens a view (shown as a color specified rectangle) owned exclusively by the user. Users are uniquely identified and can independently view, zoom, and annotate the map simultaneously. Unique colors for each of the users help distinguish ownership of the various windows that may be on the screen during interaction.

The effect in this implementation is a "looking glass" view of a disaster site; giving a highly interactive and natural interface to even novice users. While this is a successful proof of concept, many open research questions exist. The prototype has been very effective for describing our planned development to first responders, who have universally shown excitement for such a system's deployment in the field.

4. Main Points

Robots have been successfully used for:

- Structural inspection
- Underwater exploration
- Urban search and rescue (USAR)
    - 2001 World Trade Center Disaster
    - 2004 – 2005 Hurricane Seasons

What is the future for USAR Robotics and related technologies?

- We do not have a perfect robotic tool for USAR.
    - Need to work on deployment system, sensor packages, additional tracks, improved user interface, and a more intuitive control unit.
    - Still need a reach-back method.
- Future development really does depend on a tight collaboration between responders, researchers, and industry.
- No happy ending yet.
    - Commercial development has slowed down.
    - Rescuers are still responding the same way they did ten years ago.

Responses from the participants

- The presentation was well accepted and there were many questions throughout the talk.
- The topic of intrinsic safety standards for the robot was brought to the speaker. Unfortunately, no commercial robots are achieving this level of personal safety.
- Decontamination methods for robots were discussed. The VGTV's waterproofing was given as an example of how decontamination can easily happen in the field.

5. References

H. A. Yanco and J. L. Drury. "Rescuing Interfaces: A Multi-Year Study of Human-Robot Interaction at the AAAI Robot Rescue Competition." Autonomous Robots, to appear.

H. A. Yanco, M. Baker, R. Casey, B. Keyes, P. Thoren, J. L. Drury, D. Few, C. Nielsen and D. Bruemmer. "Analysis of Human-Robot Interaction for Urban Search and Rescue." Proceedings of the IEEE International Workshop on Safety, Security and Rescue Robotics, August 2006.

B. Keyes, R. Casey, H. A. Yanco, B. A. Maxwell, and Y. Georgiev. "Camera Placement and Multi-Camera Fusion for Remote Robot Operation." Proceedings of the IEEE International Workshop on Safety, Security and Rescue Robotics, August 2006.

J. L. Drury, H. A. Yanco, W. Howell, B. Minten and J. Casper. "Changing Shape: Improving Situation Awareness for a Polymorphic Robot." Proceedings of the ACM/IEEE Human-Robot Interaction Conference, March 2006.

D. Hestand and H. A. Yanco. "Layered Sensor Modalities for Improved Feature Detection." Proceedings of the IEEE Conference on Systems, Man and Cybernetics, October 2004.

6. Workshop Handouts / Resources

Presentation and support material is attached to this submission.

Further information can be found at:

http://www.cs.uml.edu/robots