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INTERIM REPORT <<<

Advances in Networked Video to Improve Safety, Effectiveness, and Security of Florida Spaceport Operations

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Reference: FSREGP Spring 2001 cycle grant (Christensen, “Advances in Networked Video to Improve Safety, Effectiveness, and Security of Florida Spaceport Operations”)

Project website: http://www.csee.usf.edu/~christen/space/main.html

Date of report: February 10, 2002

Period of performance: 1 year (starting September 1, 2001)

Total Funding: $30,000

Name of organization: University of South Florida, Department of Computer Science and Engineering
1. Summary of Project

This project has two goals. The first goal is to explore the feasibility of adding video cameras to the clothing of spaceport technicians, or video-enabled technicians. Wearable video cameras can enable real-time consultation with off-site experts and allow for archiving of procedures for later safety audits or for use as training instruments. The second goal is to investigate technologies for deployment of 100’s to 1000’s of video cameras in the local area. Video infrastructures based on such wired sensor networks have great promise for improving safety and security.

We are focusing on evaluating COTS hardware and software products for the video-enabled technician. We will complete a formal evaluation of existing products and prototype a “proof of concept” video-enabled technician. We expect to deliver video clips and images of mock procedures to demonstrate the feasibility of a video-enabled technician. For the wired sensor network part of the project, we are focusing on the emerging IEEE 1394b FireWire [1] technology as a means of building large-scale and high bandwidth wired sensor networks. We are also studying the feasibility of passive fiber connection methods that will be lower in cost and more reliable than a FireWire based solution. This work is focused on simulation modeling of FireWire and of new proposed protocols.

A website has been created for this project and is shown in the appendix of this interim report.

2. Accomplishments to Date

This grant is supporting two students and allowing for faculty release time. The students currently supported are (and will be supported until the end of project):

- Christine Bexley (http://www.eng.usf.edu/~bexley) – Undergraduate honors student
- Vijay Chandramohan (http://www.csee.usf.edu/~vchandr2) – Graduate student

In Fall 2001 the grant supported

- Christine Bexley (http://www.eng.usf.edu/~bexley) – Undergraduate honors student
- John Shahbazian (http://www.csee.usf.edu/~jshahbaz) – Graduate student

Christine is focusing on the video-enabled technician (with assistance from John in the Fall) and Vijay on the wired sensor network. The wired sensor network portion of this project has great potential for future funding. I intend to submit an NSF Network Research [2] proposal based on the preliminary results from this work. To date we have accomplished the following for the first goal:

1. Identified, acquired, and installed eight video conferencing and streaming video products on a PC test bed
2. Purchased off-the-shelf cameras and microwave communications for the video-enabled technician
3. Developed an evaluation procedure to be followed for the formal evaluation of the software and hardware
4. Developed a mock “procedure” to be used to demonstrate the feasibility of the video-enabled technician
5. Built the video enabled technician prototype and are ready for evaluation. Figure 1 shows the current system.

![Figure 1 – Prototype video enabled technician](image)

A bullet camera is mounted in the visor of a hat worn by the technician. This is shown in the head model on the top of the monitor. A wireless link transmits the video to a base station from which a network connection transports the packetized video to a remote viewer. We are currently experimenting with how much of the hardware can be placed on person and whether, or not, a tether is needed to a surface mounted transmitter.

The monitor shows a “procedure” in which a disk drive is being removed from another PC.
We have accomplished the following for the second goal:

3. Begun to track and evaluate future developments in FireWire, include IEEE 1394B fiber physical layer.
4. Begun to investigate passive fiber optical networks as a means to achieve a lower cost and more reliable network than possible with FireWire.

Figure 2 shows a video surveillance network with the key ideas of clustering around a backbone. Each link from a cluster can support multiple daisy-chained cameras added in an ad-hoc fashion. Our problem is to investigate the technologies that can implement such a network and then model them.

3. Expected Accomplishments in Remaining Time

We have several deliverables to finish before the end of the funded period of this project (August 31, 2002). We intend to accomplish the following:

1. A full evaluation of COTS software and hardware suitable for implementing a video-enabled technician
2. A demonstration of a mock procedure done by a video enabled technician. This demonstration will be done in the Information Systems Laboratory at the University of South Florida. The demonstration will include images of the set-up and video clips all of which will be placed on the project website.
3. A complete report of the video enabled technician evaluation and demonstration. The report and the above demonstration will be shared with our industrial supporter, Bionetics Photo Services in Cape Canaveral.
4. A conference paper and report describing performance evaluation of FireWire as a candidate technology for implementing high-bandwidth, wired sensor networks (e.g., for an application as a video surveillance networks). A technical disclosure may also be filed, if appropriate and desired by Florida Space Grant.
5. An NSF Networking Research proposal [2] (due June 1, 2002) for additional funding to further investigate wired sensor networks including performance evaluation and new ideas at both the PHY and MAC layers. This will be a three-year grant requesting about $200K.

References


Appendix – The Project Website

The project website is at http://www.csee.usf.edu/~christen/space/main.html. Results will be posted to this website.