Network-ready Camera System Development for All-Sky Observing System

Background:
The United States has satellite systems used to detect nuclear events. Naturally occurring events, such as meteors, can falsely trigger satellite-based detection systems. However, these natural events also can provide a powerful cross check and calibration mechanism when they are simultaneously observed with ground-based instruments. This capstone will help with the development of a ground based camera system to be used in the "ground truthig" of nuclear detection satellite systems.

Presently, investigators at Sandia National Laboratory have developed an in-house all-sky video system for monitoring meteor events. The system can be located on a rooftop and continually monitors the sky for flashes such as bright meteor fireballs. This system is based on the following components:

- Incident light enters through a fisheye lens
- A CCD-based camera records all-sky images at video frame rates
- A custom video processor digitizes the video and detects frame-to-frame changes
- Video of detected events is presented to a PC for recording.

The computer stores the images for later processing and event cataloging. The current system requires manual scanning of the images to search for significant events. Additionally, the system is not well-coordinated for time-tagging and significant user involvement is required to relay event information.

This capstone will look to implement a camera system using newer network ready cameras for utilization in the camera network system

Capstone Tasks:
1. Research available network-ready cameras for use in the observing system
Considerations include: light sensitivity, lens arrangement, on-board software for image masking and change detection, accuracy of time stamping

2. Research autonomous power options (e.g., solar cells).
Considerations include: weather proofing, length of time for recharge, expected battery life, weight

3. Purchase several (at least 2) network-ready cameras. Project funding may be able to support the purchase of one or both of these cameras. Capstone funding will be used for the purchase of other project components

4. Test cameras in the laboratory
Considerations include: image distortion, sensitivity, software operation, relation between time stamps and camera-to-camera distance for future event correlation

5. Test camera outdoors with autonomous power
Considerations include: masking of each camera for regions of non-interest (e.g., light poles), possibility to automatically mask the blue sky for regions of interest, estimation of

charging capability based on light input, automated camera to server message if insufficient power for night-time operation

6. Interface cameras with NMSU All-Sky Network Server
Considerations include: adapting existing client-server communications (data dumps) to the onboard camera OS, use of wireless internet links

7. Develop and execute plan to place cameras on building roof (T&B or other?) for nighttime operation.
Considerations include: self-contained weather proof housing, ease of installation,

8. Analysis of data and comparison with existing camera systems.

Satisfaction of capstone checklist: (according to Laura)
Significant design—will require significant analysis skills to choose system components, as well as interfacing, housing, and trouble shooting
Knowledge of at least 3 areas of ECE—Optics/image processing, networks/communications, power
Level worthy of 6 hours—check
Creativity and deductive reasoning—check
Teamwork—will work with 3+ team members
Deliverable—possibility to actually use the project deliverable in a "real" funded project
Time line—2 semesters
Design review board—Laura Boucheron, David Voelz (both on the Sandia grant), other faculty from any of the three