

DATE: February 1, 2001
TO: Hang Li and Dr. Dean Neikirk
FROM: Natthanant Pon Skulkaew and Prem Nainani
SUBJECT: A proposal to build a portable, PC-based data acquisition and wireless transmission system.

PROJECT SUMMARY

The goal of our project is to build a portable, PC-based data acquisition and wireless transmission system for use in chemical analysis applications. Our objectives are to put together a system which captures images from a video stream and wirelessly transmits them to the internet along with an exact geographical location of where the image was captured. We will build our system on a portable, ruggedized PC and the entire unit will be self-contained and battery operated to facilitate field testing.

BACKGROUND

Over the last year, research groups at UT have developed an automated process for collecting image data from chemical sensors known as the “Electric Tongue.” The chemical sensors are micro-machined beads which change color when exposed to certain chemicals [1]. After an image of the sensors is acquired, data is extracted and the image is compared to a database of previously recorded images. By comparison, the identity of an unknown chemical can be deduced. Used in a military setting, these sensors could facilitate early detection of hostile chemicals. We will realize this system by using commercial hardware and software to acquire sensor data and wirelessly transmit it to the Internet.

Integrating several specialized systems on both hardware and software levels sparked our interest. Since we are fascinated with the developing wireless world, putting together a wireless communications link also appealed to us. We strongly believe that we are qualified for this project because we each have extensive experience with system integration and testing from our internships. Also, our background in electromagnetics reinforces our qualifications.

PROBLEM DESCRIPTION

The goal of this project is to construct a portable, PC-based data acquisition and wireless transmission system. The PC will capture images from an input video stream in order for them to be analyzed. The video will either be in Super-Video (S-Video) format or in the National Television Standards Committee (NTSC) format. After analysis, the PC will transmit the image and its accompanying data, along with an exact geographical location of where the video/image was taken, via a wireless communications channel. Any image or data processing done before transmission is not part of the project.

APPROACH

Because military settings are characterized by harsh conditions that require the use of ruggedized equipment, our system will be implemented on a ruggedized PC. We will first research different types of image acquisition and wireless transmission equipment to find the most compatible configuration to function on a ruggedized PC. Finding the proper equipment to implement a Global Positioning System (GPS) in our system will also be considered. All equipment will be researched and purchased from commercial manufacturers. We will design the necessary software interface methods once we have all the parts.

SPECIFICATIONS

Ruggedized equipment can be fairly expensive. In the unlikely event that funding limitations prevent us from using a ruggedized PC, Dr. Neikirk is allowing us to assemble a demonstration model that will perform the same tasks as the ruggedized unit. Nevertheless, we have included a set of minimal requirements for both the demonstration unit and the ruggedized one.

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|---------------------|---|
| Demonstration Unit: | <ol style="list-style-type: none">1. A 200 MHz processor and 64 MB RAM2. Image capture card with a 1 image/minute update rate3. Wireless capability within commercial cellular coverage |
| Ruggedized Unit: | <ol style="list-style-type: none">1. All requirements for Demonstration Unit2. Flexibility: PCI and PCMCIA interface3. Battery Powered4. Weight<ol style="list-style-type: none">a. PC – 50 lbs.b. Battery – 35 lbs.5. Operating temperature range: 40°F - 120°F |

PROPOSED ACTIVITIES

First of all, we must search for the necessary components for our project. Currently, we are using the internet to explore the availability of products. Next we must evaluate certain specifications of these products such as performance, compatibility, and cost. In order to do this, we will have to contact the product vendors by telephone. Once we have chosen an optimal system configuration, we will purchase the chosen components. When the products arrive, we will then proceed to integrate the hardware and install any software that is required such as an operating system, device drivers, image processing software, and wireless internet programs. It is also necessary to design a method to display the transmitted data. This may take the form of a website that is updated automatically, using a process we will design. Finally, we will test and evaluate the performance of this system. Since the portable PC is for military applications, we may also perform a series of “field tests”, putting the system in adverse conditions. These conditions may include driving through bumpy areas, subjecting the PC to extremes of temperature, and using it in areas where wireless signals are weak.

INDIVIDUAL CONTRIBUTIONS

Although we each plan to participate in all tasks involved with this project, each of us will have a dominant role. Pon will be primarily in charge of the data acquisition system, and Prem’s responsibilities will focus on the wireless transmission system. We will prepare all written materials and presentations as specified in the course notes.

RESOURCES

As previously mentioned, our current source for product information is through vendor websites. When we begin to build the system, we will be referring to the product documentation. For guidance and evaluation of our progress we plan to consult our TA, Hang Li, and our supervising professor, Dr. Neikirk.

ESTIMATED COSTS

We are working fifteen hours a week towards our project and plan to continue working at this rate. We also plan to keep meeting with Hang Li and Dr. Neikirk weekly. Please refer to Table 1 on the following page to see an itemized list of project costs.

Table 1. Estimated Cost

Item description	Costs
Ruggedized portable-PC	\$10,000
CCD card	\$200
GPS locator	\$200
Wireless modem	\$150
Wireless ISP fee	\$50/month
Total (based on 4 months of ISP service)	\$10,750

SCHEDULE

Table 2 below is our project schedule.

Table 2. Preliminary Schedule

Date	Task
Jan. 18	Begin purchase and acquisition of necessary hardware and software
Feb. 1	Proposal Due
Feb. 6	Purchase and acquisition complete, begin system design
Feb. 26	Begin implementation of design and component integration
Mar. 6	Progress reports due
Mar. 16	Completion of image acquisition system
Mar. 31	Completion of wireless transmission system
Apr. 1	Begin testing, evaluation, possible re-design
Apr. 10	Final oral and demo
May 3	Final Project Report

CONCLUSION

Our equipment research is moving smoothly, and we strongly believe that we will finish all aspects of this project by the given deadline. Upon completion, our data acquisition and wireless transmission system will facilitate field testing for chemicals. Its wireless capabilities will allow for almost instant access to data gathered in the field. Our system, used in conjunction with the “Electric Tongue,” will serve as an invaluable aid for military reconnaissance. The only limitation we foresee concerns the accessibility of funds. It can take almost two months for large amounts of funding to be approved, and this could delay our project. Should this be the case, we will design and build our system as described in the specifications for the demonstration unit. Regardless of budget, we are confident in having a fully functional data acquisition and wireless transmission system by the given deadline.

REFERENCES

- [1] "AutoImage Summary,"
<http://weewave.mer.utexas.edu/DPN_files/courses/464H/imaging_Sp99/AutoImage%20Summary/Summary.htm> Accessed Jan. 28, 2001.