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October 17, 2002

Dr. Andrew Rawicz
School of Engineering Science
Simon Fraser University
Burnaby, BC V5A 1S6

Re: *ENSC 340 Functional Specification for an Intelligent Monitor Power Saving Security System*

Dear Dr. Rawicz:

The attached document, *Functional Specification for an Intelligent Monitor Power Saving Security System*, details our ENSC 340 project functional specifications. Our mission is to develop an intelligent sensor unit integrated with computers to improve power consumption, end user's experience and security. Our product will detect the presence of computer users and activate power management and security protection accordingly.

This functional specification provides an overview of our system, physical, software and hardware requirements. In addition, regulatory and safety specifications are provided.

InfraVision consists of six dynamic, innovative and motivated fourth year engineering students: Victor Song, Hans Ting, Harry Chen, Sae-Won Lee, Susan Chiu and Wayne Huang. If you have any questions or concerns with our functional specifications, I can be contacted at 604-291-8498 or by email at iv-ensc@sfu.ca.

Sincerely,

Victor Song

Victor Song
CEO and Chairman
InfraVision

Enclosure**:** *Functional Specification for an Intelligent Monitor Power Saving Security System*

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SenSaver™

ENSC 340 Functional Specification by

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Submitted: October 17, 2002

Executive Summary

Many computer operating systems come loaded with features to suspend the monitor after a certain time of inactivity. However, these features are usually disabled because computer users are frustrated by the activation of the screensaver or suspension of the monitor when users are inactive, such as in watching a DVD movie, or the viewing of a document.

Our proposed product, SenSaver™, aims to reduce the power consumption of computers, improve the end users' experiences, and provide security protections. Our product uses intelligent IR sensors mounted on the monitor to detect the presence of users. If a user leaves the workstation, power management and security protection will be automatically activated.

This document provides an overview of our system and details the functional requirements of the system hardware, software, and safety.

Table of Contents

List of Figures

Glossary

CE	Certification mark from European Commission for consumer and industrial products
CRT	Cathode Ray Tube, used in traditional monitors
CSA	Canadian Standards Association, an international non-profit organization that develops standards for product certification
FCC	United States Federal Communications Commission, regulates electromagnetic spectrum and noise emissions
IEC	International Electrotechnical Commision, an international organization for worldwide standardization in electrotechnology
IR	Acronym for Infrared
LCD	Liquid Crystal Display, a technology for producing low-power and low-profile monitors
LED	Light Emitting Diode
Proximity Sensor	A sensor that detects how far away an object is from the sensor
Transceiver	A device that transmits and receives signals
UI	User Interface
UL	Underwriters Laboratories, a not-for-profit product safety testing and certification organization
USB	Universal Serial Bus

1. Introduction

Research shows that in a typical computer system, the monitor consumes about 50% of the total energy. When a user is away from the computer, the energy consumed by the monitor becomes wasted energy. An American university calculated that the annual energy costs for their IT systems were in excess of six hundred thousand dollars, which was reduced by half with power saving features implemented.

Our proposed product, SenSaver™, is a device that aims to provide efficient power savings for computers while improving end users' experiences. Utilizing triangulation techniques, IR sensors mounted on top of monitors will determine the presence of users. When a user is away from the computer, the power management will be activated immediately. For users with needs for security protection, SenSaver Pro™ is designed with user identification capabilities in addition to the power management features.

This project will be developed in stages. A proof of concept device will be developed by December 2002, with further development to follow for commercialization. Because of the differences between the requirements for the prototype and the commercial version, we colour-code our requirements as follows:

Blue – denotes a requirement for both the prototype and the commercial product
Red – denotes a requirement for the commercial product.

The functional requirements are further categorized as follows:

[HW#] – denotes a requirement for the hardware
[SW#] – denotes a requirement for the software.

2. System Overview

Figure 1 illustrates the system overview of SenSaver™. SenSaver™ is a USB device attached to computers. An integrated infrared sensor within SenSaver™ is used to detect the presence of the user. When the user walks out of a user-defined range, the power management is activated immediately.

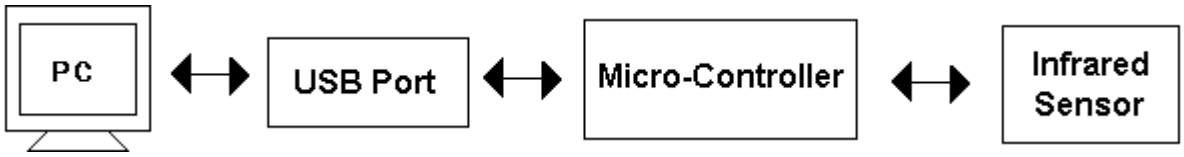

Figure 1. SenSaver™ System Overview

Figure 2 illustrates the system overview of SenSaver Pro™. SenSaver Pro™ consists of two components: the base unit and the security tag. The base unit has the same hardware as SenSaver™, with the addition of an infrared transceiver. When a user walks away from the computer, the computer will be locked immediately, in addition to the power management activation. When a user returns, a handshake process will take place between the tag and the system through the IR transceivers. Encrypted passwords are exchanged during the process, and the process is transparent to the user. Once the user has been identified as an authorized user, the system will log in the user automatically; otherwise unauthorized users will not be granted access into the computer.

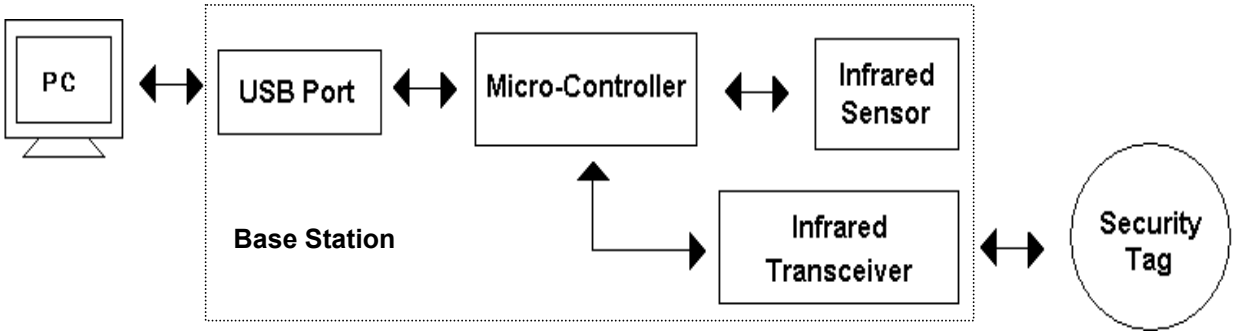

Figure 2. SenSaver Pro™ System Overview

3. System Requirements

3.1 Performance

[HW01] Upon detecting the presence of users, the system's response time shall be less than two seconds.

[HW02] The detection range of the unit shall be accurate within 15% of the distance configured by the users.

3.2 Compatibility

[SW01] The unit shall be compatible with Windows 98.

[SW02] The unit shall be compatible with most consumer operating systems supporting the USB protocol, including Windows 9x/NT/2000/XP, Linux, and OS X.

3.3 Serviceability

[SW03] The software shall be upgradeable by end users.

[HW03] The internal circuitry of the unit shall not be serviceable by end users.

3.4 Known System Limitations

The system will not be able to distinguish a person from an object. Because users will be able to configure the detecting range of the proximity sensor, the probability of detecting the presence of a non-human object can be reduced through user configurations. Moreover, considering the cost versus effectiveness, we have chosen not to implement the feature.

3.5 Test Plan

1. The system will be timed for the response time for activating the power management when users' absences are detected.
2. The system will be timed for the response time for restoring the previous monitor states when users' return to workstations.
3. The output of the proximity sensor will be tested to ensure that the actual detecting distance falls within 15% of the user-configured distance.

4. Physical Requirements

4.1 Base Station

[HW04] The base station shall be capable of operating at the temperature range from 0°C to 60°C.

[HW05] The base station shall be capable of operating under all domestic humidity and pressure ranges.

[HW06] The heat dissipation of base station exterior shall be under 30°C.

[HW07] The base station shall be easily attachable to different types of monitors.

[HW08] The base station shall be aesthetically appealing.

4.2 Security Tag

Security tags will be worn by the users; therefore the tags should be as small and lightweight as possible, while at the same time providing maximum battery life.

[HW09] The physical dimension of the tag should not exceed 4cm x 4cm x 1.5cm

[HW10] The weight of the tag shall not exceed 150 grams.

4.3 Test Plan

1. The base station will be put under extreme temperature, humidity and pressure environments to see if the unit will continue operating.
2. The base station will be put under load for 3 hours, and the temperature of the unit will be measured and compared with the requirements.
3. Attempts will be made to mount the base station on various 15’ and 17’ CRT and LCD computer monitors to test the compatibility of the unit.
4. The physical dimensions of the security tags will be measured and compared with the requirements.
5. The weight of the security tags will be measured and compared with the requirements.

5. Software Requirements

5.1 Installation Files

[SW04] The installation wizard shall lead users throughout the installation process.

5.2 Device Drivers

[SW05] The device drivers must allow the computer to communicate with SenSaver™ when SenSaver™ is plugged into the USB port.

[SW06] The device drivers shall be upgradeable by end users.

5.3 User Interface Program

[SW07] The UI must allow users to enable or disable the device.

[SW08] The UI must allow users to set the detecting distance of the proximity sensor.

[SW09] The UI must allow users to add multiple security tags to the computer database.

[SW10] The UI must allow users to remove security tags from the computer database.

[SW11] The UI must be able to communicate with the base station to determine whether a user is authorized or not when security protection is enabled.

[SW12] The UI must provide users the option of turning off a monitor or turning on a screensaver when users are not present.

[SW13] The UI must be able to automatically activate power management when users are not present; if security protection is enabled, the UI must lock the workstation when users are not present.

[SW14] The UI must be able to automatically restore the monitor to the previous operational state when users return to the workstations; if security protection is enabled, the UI must be able to automatically log in authorized users and reject unauthorized users.

[SW15] The UI must allow privileged users to set the administrator password.

[SW16] A help page must be accessible from the application.

5.4 Encryption Scheme

[SW17] A reliable encryption scheme must be developed such that the exchanged passwords will not be exposed when the IR signals are captured, and that the captured signals cannot be reused to log in unauthorized users.

[SW18] The encryption and decryption process between the base unit and the tag must be done within one second so that this process appears transparent to users.

5.5 Test Plan

1. Different versions of the device drivers will be used to test if the device drivers can be upgraded.
2. The system will be enabled and disabled through the UI program and the result will be tested.
3. Multiple security tags will be added and removed through the UI program, and attempts will be made to gain access into the locked system using the tags. The system's ability to accept authorized users and reject unauthorized users will be tested.
4. The IR signals sent from the base stations and the security tags will be captured with handheld devices (eg. Palm Pilot) to see if the signal messages can be decoded or reused.
5. The encryption and decryption time of the system will be measured and compared with the specification.

6. Hardware Requirements

6.1 Base Station

[HW11] The base station must be able to send and receive infrared signals to and from the base station within a range of 1.2 meters.

[HW12] The base station shall utilize a type-B USB cable connector to establish a connection with the computer.

[HW13] The base station shall be able to sense the presence of an object within 1.2 meters.

[HW14] The base station shall be able to determine the distance between an object and the base station if the object is within 1.2 meters.

[HW15] The base station shall indicate the presence of an object with an LED.

6.2 Security Tag

The most important feature of the tag is to automate the process of unlocking a secured workstation and logging in. The tag must be able to establish a secure communication with the base station through the IR transceivers. Thus, the following requirements are expected from the security tags.

[HW16] The tag shall be able to establish an encrypted communication with the base station to exchange security information.

[HW17] The tag must be able to send and receive infrared signals to and from the base station within a range of 1.2 meters.

[HW18] The battery within the tag must support for a continuous operation of at least one month.

[HW19] The tag should utilize an on/off switch or a triggering button to save power consumption when not being used.

[HW20] The communication between the tag and base station must be immune to noise from computers and other electronic devices.

6.3 Test Plan

1. The security tags will be placed at various distances from the base station to verify the maximum working distance and the system's accuracy of determining the distance.

2. The base station and the security tag will be close to various electronic devices and the system's communication quality will be determined.

7. Regulatory and Safety Requirements

As SenSaver™ is a device intended for computer users, a number of safety and regulatory requirements must be met to ensure the users' safety.

[HW21] The unit shall not possess sharp edges or points that can potentially injure the user.

[HW22] SenSaver™ shall be UL, CSA and CE approved for domestic use.

[HW23] SenSaver™ shall meet the following safety standards:

i) CSA C22.2 No 1010.1-92
ii) IEC 1010-1:1990+A1:1992+A2:1995
iii) UL 3111-1
iv) EN 50082-1:1997

8. Conclusion

In this document, we have carefully considered the requirements for a system that is environmental, economical, secure, and practical. We have defined the system requirements with respect to physical, software, hardware, and safety. We will use these specifications as a framework for our development, and we will strive to complete the prototype requirements by December 2002. As time permits, we will also complete as many commercial requirements as possible.

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