Secure Solutions

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Dr. Andrew Rawicz
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Re: ENSC 340 Functional Specification for a Motion Sensitive Laptop Anti-theft Device

The attached document, *Functional Specification for a Motion Sensitive Laptop Anti-theft Device*, describes the functions of our entire system for ENSC 340.

We are currently designing and prototyping a laptop anti-theft device that comprises of a pair of programmable units that will alert a laptop owner of any possible theft attempts. The contrivance, called the Infiltrator, features automatic arming and disarming based on the proximity of the owner to his laptop, and enables the owner to screen for false alarms.

The purpose of this functional specification is to list the roles and functions that our system will accomplish. The following document will separate what parameters will be completed for the span of the project course and which will be done in the future to achieve a market-quality system.

Secure Solutions consists of five engineering students: Vincent Au-Yeung, Matt Brown, Steve Lau, Hani Mehrpouyan, and Chris Mitchell. If you have any questions or concerns in, please feel free to contact Chris Mitchell, our contact person, by phone at (604) 984-8771 or by email at chrism@sfu.ca.

Sincerely,

Chris Mitchell

Chris Mitchell
COO
Secure Solutions

Functional Specification for a

Motion Sensitive Laptop Anti-theft Device

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i

Executive Summary

Theft of laptops continues to be on the rise for business people and others who travel with their notebooks. Over 600,000 laptops were stolen in the United States last year, an increase of 53% from the previous year. Unfortunately, the increasing popularity of laptop computers has spawned substantial black markets in both stolen computers and stolen confidential business data.

Secure Solutions is developing the Infiltrator, positioned as a stand-alone anti-theft device that will advance the combat of laptop theft. Our invention will consist of two microcontroller and transceiver based units: a theft detector mounted on the laptop itself and a remote control unit to be carried by the owner of the laptop. Once the detector senses any kind of motion, it sends a discrete signal (beep) to the Remote. The owner can then activate the alarm on the theft detector, thereby interrupting an attempted theft, or they can screen the signal and suppress the alarm, thereby avoiding false alarms. If the user does not reply to the discrete notification signal after a short period of time, the siren will be automatically activated.

The development of the Infiltrator will transpire in two phases: the prototyping phase, to be completed in December 2002; and the second phase that will lead to a production-quality device.

The initial prototype phase will include these key features:
1. The automatic arming and disarming of the device based on proximity of the Remote to the detector.
2. Instant notification to the owner upon movement of his/her laptop.
3. Owner has ability to suppress alarm when located within range of the system.

The second phase will also accomplish the following:
1. Be contained and fully enclosed in an appropriate package.
2. Be a robust, sturdy, reliable consumer usable device.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

The Infiltrator is a dual-unit system that uses RF communication to interact between its Base unit and Remote to send the status of the owner's laptop to him/her and notify of any possible theft attempts. The entire device will automatically arm and disarm itself based on the proximity of the owner to his/her laptop.

The Infiltrator is intended to improve the user's capability of preventing laptop thefts and provides piece of mind to the owner that their laptop's safety is virtually guaranteed. A proof of concept prototype will be completed in December of 2002 and will be followed by additional improvements in preparation for commercial deployment.

1.1 Acronyms

FAQ   Frequently Asked Questions
RF   Radio Frequency
SS   Secure Solutions

1.2 Glossary

Remote: Keychain-like device carried by the owner that is notified by the Base unit upon any movement of the laptop.

Base unit: Package mounted on the laptop that senses motion and sends notification and receives commands to/from the Remote.

1.3 Referenced Documents

[1]   Proposal for a Motion Sensitive Laptop Anti-theft Device with Mobile Screening and Automatic Proximity Arming/Disarming. Secure Solutions.

[2]   AN001 -- SRD regulations for license free transceiver operation. Chipcon.

1.4 Objectives

The following convention is used throughout this document to indicate functional requirements:

[R#]   A Functional Specification

To denote the priority of each given requirement (n) will be appended to the beginning of each functional specification as per:

(1)   A functional necessity for both the proof of concept device and the production contrivance.

(2)   A functional requirement for only the proof of concept device.

(3)   A functional requirement for only the production contrivance.

2   System Requirements

2.1   System Overview

Figure 1 offers a visual representation of the Infiltrator and its interfacing. The Base unit and the laptop will be securely attached together, essentially making it near impossible to separate, while the Remote will be a key chain item that the user will carry on his/her person. The Base unit and Remote will communicate via transceivers, and once the Remote is found to be a certain distance apart from the laptop, the system will arm itself. Once armed, the base will wait for a detection of movement of the laptop and it will then send a signal to the Remote wherein the user can screen the alert and choose to abort the alarm from sounding if a theft is deemed to not be in progress.
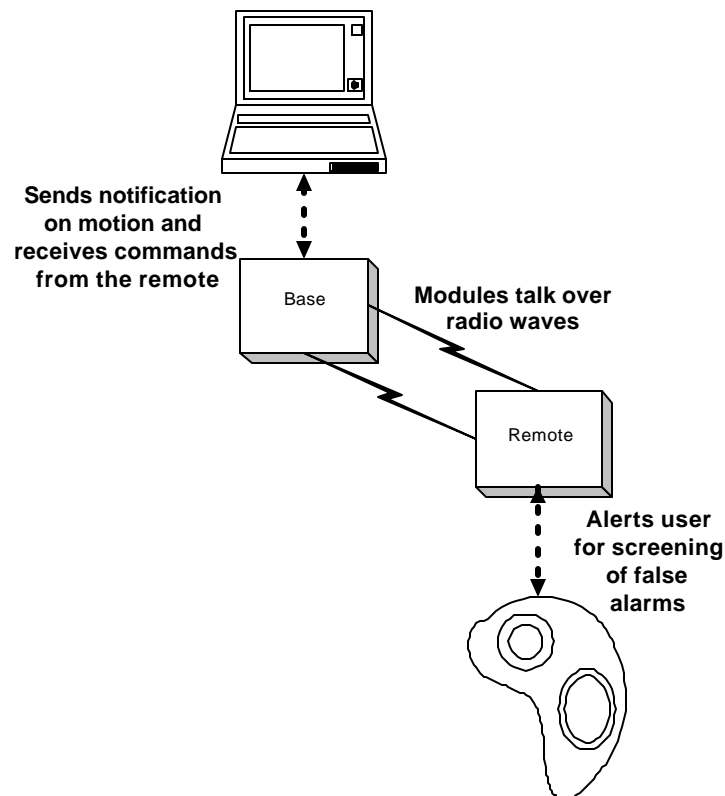
Figure 1 – Dual Unit Anti-theft Device Overview

3 Base unit Requirements

3.1 General

Table 1 – Base unit Environmental Requirements

			Minimum	Maximum
[R1]	(1)	Operating temperature	-20°C	60°C
[R2]	(1)	Operating humidity	0%	100%
[R3]	(1)	Heat dissipation	N/A	Minimal (pW range)

3.2 Physical

Table 2 – Base unit Physical Dimensions

			Minimum	Maximum
[R4]	(3)	Height	N/A	3 cm
[R5]	(3)	Width	N/A	12 cm
[R6]	(3)	Length	N/A	12 cm
[R7]	(3)	Mass	N/A	150 g

[R8] **(3)** The Base unit shall be within a black enclosure to maintain stealth.

3.3 Range

Table 3 – Base unit Transmission Requirements

			Minimum	Maximum
[R9]	(1)	Low-power transmit	8 m	10 m
[R10]	(1)	High-power transmit	60 m	N/A
[R11]	(1)	Current consumption	N/A	15 mA

3.4 Reliability

Table 4 – Base unit Power Requirements

			Minimum	Maximum
[R12]	(3)	Standby time	1 week	N/A
[R13]	(3)	Charges in charger life	1000	N/A
[R14]	(3)	Life expectancy	10 years	N/A

[R15] (3) The Base unit shall be tamper-resistant and shock-resistant (unable to be disarmed by a thief without triggering the siren, and capable of handling accelerations of at least 15 m/s^2).

[R16] (3) The Base unit shall be water resistant (immune to coffee spills and splash from rain).

[R17] (1)   The Base unit shall not be the source of "signal jamming" or any form of signal interference, nor shall the Base unit be vulnerable to such external RF interference.

[R18] (1)   The Base unit shall be able to receive appropriate manual override commands at any time from the Remote unit if the Remote is within transmitting range.

3.5 Motion Detection

[R19] (1)   The Base unit shall be able to detect motion in all three geometric planes.
[R20] (1)   The Base unit shall be able to distinguish the severity of the detected motion.
[R21] (1)   The Base unit shall be able to ignore vibration equivalent to a heavy truck driving by or the slamming of a door.
[R22] (1)   The Base unit shall be able to notify the Remote unit of any detected motion.
[R23] (1)   The Base unit shall be able to automatically sense the proximity of the Remote unit at any time and subsequently arm or disarm itself.
[R24] (1)   The Base unit shall sound a warning if motion is detected for less than one second.
[R25] (1)   The Base unit shall sound a full-blown siren if motion persists for greater than 1 second and has not received an override signal from the Remote.

3.6 Safety

[R26] (1)   The Base unit shall not be the cause of any physical ailment related to RF transmission.
[R27] (1)   The Base unit shall not emit an audible siren greater than 90dB.
[R28] (1)   The Base unit shall not cause any "shock" from human handling.
[R29] (3)   The assembly will have smooth and symmetric edges and corners.
[R30] (1)   All electrical connections will be enclosed and present no danger to the user.

4 Remote Requirements

4.1 General

Table 5 – Remote Environmental Requirements

			Minimum	Maximum
[R31]	(1)	Operating temperature	-20°C	60°C
[R32]	(1)	Operating humidity	0%	100%
[R33]	(1)	Heat dissipation	N/A	Minimal (pW range)
[R34]	(1)	Power supply	2.7 V	3.3 V

[R35] (2)   The prototype will be powered using lithium batteries.
[R36] (3)   The commercial unit will have rechargeable batteries.
[R37] (3)   The commercial unit shall have a port for charging the batteries.
[R38] (3)   All device components shall be housed inside a rigid enclosure of sufficient strength.
[R39] (3)   The Remote shall have a low-battery indicator.

4.2 Physical

Table 6 – Remote Physical Dimensions

			Minimum	Maximum
[R40]	(3)	Height	0.5 cm	1.5 cm
[R41]	(3)	Width	2 cm	4 cm
[R42]	(3)	Length	4 cm	6 cm
[R43]	(3)	Mass	N/A	50 g

[R44] (1)   The buttons shall be recessed yet easily accessible.
[R45] (3)   The antenna shall be enclosed in the Remote's housing.
[R46] (3)   The charger adapter shall be made of stainless steel.

4.3 Range

Table 7 – Remote Transmission Requirements

			Minimum	Maximum
[R47]	(1)	Low-power transmit	3 m	5 m
[R48]	(1)	High-power transmit	60 m	N/A
[R49]	(1)	Current consumption	N/A	10 mA

4.4 Reliability

Table 8 – Remote Power Requirements

			Minimum	Maximum
[R50]	(3)	Standby time	1 Month	N/A
[R51]	(3)	Charges in charger life	1000	N/A
[R52]	(3)	Life expectancy	10 years	N/A

[R53] (3)   The Remote shall be shock-resistant (capable of accelerations of at least 15 m/s^2).

[R54] (3)   The Remote shall be water resistant (immune to coffee spills and splash from rain).

[R55] (1)   The Remote shall not be the source of "signal jamming" or any form of signal interference, nor shall the Remote be vulnerable to such external RF interference.

4.5 Safety

[R56] (1)   The Remote shall not be the cause of any physical ailment related to RF transmission.
[R57] (1)   The Remote shall not emit an audible siren greater than 50dB.
[R58] (1)   The Remote shall not cause any "shock" from human handling.
[R59] (3)   The assembly will have smooth and symmetric edges and corners.
[R60] (1)   All electrical connections will be enclosed and yield no danger to the user.

5   Regulatory Requirements

The Infiltrator is a device that will be used by customers throughout the world. European RF regulations differ from the North American regulations, with the main differences being transmitter frequency. Therefore, slight modifications on the North American model will be needed to account for these differences.

[R61] (3)   The Infiltrator will be UL, CSA and CE approved for domestic use.
[R62] (1)   It will follow the CSA C22.2 No 1010.1-92 safety specification, IEC 1010-1:1990+A1:1992+A2:1995, and UL 3111-1.

        North America Model:

[R63] (1)   Infiltrator will follow the Federal Communications Commission (FCC) regulations for unlicensed RF operation (CFR 47, Part 15).
[R64] (3)   The final product has to be marked with a Federal Communications Commission (FCC) identification label (ref. Part 2.925 and 2.926).
[R65] (3)   It will be certified under FCC CFR 47, Part 15.249.

        European Model:

[R66] (3)   Infiltrator must comply with EN 300 220.
[R67] (3)   It will follow the ERC regulation CEPT/ERC/70-03.
[R68] (3)   It will meet the requirements outlined in ETS 300 683.

6   Documentation and User Training

While most users will be familiar with keychain-alarm type security systems, SS feels that all users, regardless of past experience should be able to comfortably use the production device with the same amount of proficiency. To aid in this goal, the following requirements have been set for documentation and user training of the device.

[R69] (3)   All documentation and user training for the production device will be provided in the form of a user manual that is distributed with the final consumer package.

[R70] (3)   The user manual will provide instructions on how to use all features of the production device.

[R71] (1)   Minimal training should be necessary for the device.

[R72] (3)   The user manual will describe in detail proper installation of the device.

[R73] (3)   The user manual will include FAQ and troubleshooting sections.

[R74] (3)   Any necessary addendums or revisions to the user manual will be made freely available on the SS website.

[R75] (3)   The user manual will be written for an audience with little experience with such devices. To this end, the user manual will include as few words as possible, opting for clear diagrams instead.

[R76] (3)   Device characteristics and other pertinent information relevant to the final user such as specifications and contact information will be included in the user manual.

[R77] (2)   Users of the proof of concept device will be instructed by the product developers on how to use the device.

7 Testing

The Infiltrator will undergo a rigorous set of tests to check that all functions work accordingly.

[R78] (1)   The system shall undergo RF transmission range testing in an indoor office environment and in an outdoor open-field environment to ensure it meets the transmission range requirements.

[R79] (3)   The system will be tested in various locations where laptop thefts frequently occur to check that accurate functionality and range is achieved.

[R80] (1)   The Base unit shall be mounted on the back of a display panel of a standard laptop computer and undergo motion sensitivity testing to ensure requirements are met (i.e. picking the laptop up from a desk, walking around with the laptop, testing its sensitivity to bumps, etc).

[R81] (1)   The Remote shall be able to always manually override the Base unit with its own instructions at any time when within transmission range, and the Base unit shall be able to recover "automatic" functionality without system reset when overridden.

[R82] (1)   The system should reject any signals not covered by the protocol specification (i.e. other devices that may be transmitting at an adjacent frequency and spilling over into ours).

[R83] (1)   The Base unit shall prevent thefts with the deterrent warning sound at the onset of detected motion or trigger the full-blown siren if motion persists. In both cases, the remote unit will be notified if it is within range.

8 Conclusion

The specifications set out by this document provide a thorough description of functionality of our device. The main aspects of the system for which serviceable stipulations are provided include the RF communications between units, safety to the end user, physical and operating condition specifications, and range and reliability. This document will provide a basis for design process and a more complete set of specifications is expected once the proof of concept device is completed. As a reference, these stipulations will also be useful for tracking project performance and meeting certain milestones; as well as an exhaustive test plan to check the reliability of our system in real world conditions.