

Tuesday, February 22nd, 2005

Mr. Lucky One
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Simon Fraser University
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Re: ENSC 440 Functional Specification for a Wireless Home Security System

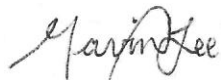
Dear Mr. One,

The enclosed document, Functional Specification for a Wireless Home Security System, outlines the System's features and possible user actions. Our goal is to design a wireless home security solution that notifies the homeowners via their computer or a cell phone, in case of fire, flood, or break-ins.

The Functional Specification states what the WHSS will be able to do when the first version is completed in April 2005. This report attempts to cover these issues without going onto comprehensive details about how it is to be done.

Our company, WInnovations, is comprised of four 5th year SFU engineering students:. If you have any questions please feel free to contact us at ensc440-security@sfu.ca.

Sincerely,



Gavin Lee
CEO
WInnovations

Enclosure: Functional Specification for a Wireless Home Security System



Functional Specification for a Wireless Home Security System

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Issued date:

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Executive Summary

Smash! A window at the Jones' home is broken. The alarm goes off, the security system is called into action, and a call to the police is made. But the police department never hears their phone ring... And the thieves get away with thousands of dollars worth of furniture and jewelry.

The problem is that many other home security systems, such as those provided by ADT, rely on only one method of action-telephoning authorities. What happens if the phone lines happen to be busy? What happens if the phone provider is having problems? What happens if you haven't paid your phone bills? Often, a five-minute lapse in phone service combined with perfect timing by the thieves can result in the above worst-case scenario.

The Wireless Home Security System from WINnovations aims to alleviate this problem by providing multiple courses of action, should an intrusion be detected. In addition to contacting authorities as a last resort, the Wireless Home Security System can notify you via e-mail, SMS message, or a user-definable voice call to a cell phone or other number of your choice. You will be given the choice of whether or not to contact authorities.

WINnovations was formed by four 5th-year Simon Fraser University engineering students, whose specialties range from computer programming to electronics system design. Put together with effective time management and organizational skills, WINnovations foresees being able to complete this project on time and within budget.

We are now entering the prototyping stage of the project, which is to develop a first working model of the Wireless Home Security System. This is expected to be demonstrated in the first half of March.

This is the second of four documents regarding our project that will be released. The proposal was released on January 25, 2005. The design specification, which involves the inner details of the Wireless Home Security System, is slated for release in the second week of March. The post-mortem will be released shortly after presentation of the project, and is currently targeted for mid-April.

This document states the features of the Wireless Home Security System. The hardware, software, and documentation (including the user manual) will have specific requirements that will be mentioned. You will find in this document what actions you can carry out with the Wireless Home Security System, as well as definitions related to human usability of the WHSS. We hope it will improve the convenience of your future home security system.

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1 Introduction

1.1 Scope

This functional requirements document outlines the operational requirements of the Wireless Home Security System. The requirements specified in this document pertain to the specific details of each of the components associated with the security system which include quantitative, qualitative and usability requirements. Requirements specified in this document will correspond to the design specifications documentation for this product to provide a useful guideline for the design phase.

1.2 Acronyms

Table 1 shows the acronyms that will be used in this document:

Table 1: Acronyms	
Term	Definition
API	Application Program Interface
FR	Functional Requirement
SMS	Short Message Service
WHSS	Wireless Home Security System

1.3 Conventions

The convention for defining requirements used in this document will consist of the following symbols preceding the details to denote a specific requirement:

[FR#][prefix code] <Requirement Details>

The prefix codes are defined as follows:

[h] Hard requirements: The Wireless Home Security System will perform these functions exactly as they are stated.

[s] Soft requirements: The WHSS will perform these functions though the requirements may deviate slightly from what is stated.

[t] Tentative: These functions are possible future implementations and may or may not be included in the first version of the WHSS, due in April 2005.

2 System Requirements

2.1 System Overview

In the wireless home security system, sensors will be placed in various settings in a home. Their status will be constantly monitored and if the sensor goes off or has detected a state of danger (smoke detection, flood detection, and home intrusion), a wireless signal will be sent to a PC via a wireless transmitter that is located in a different location. Depending on the user's preference, the information can be sent from the PC to the user via e-mail or SMS for notification, assuming that the PC is turned on. Figure 1 shows the conceptual overview of the security system [2].

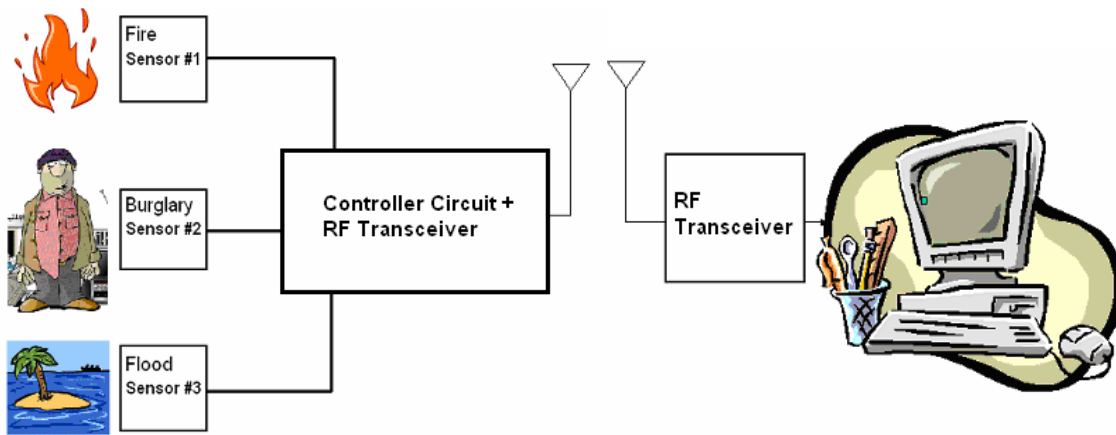


Figure 1: Conceptual Overview

2.2 System Requirements

Assessing the requirements is vital for the integration of the various components of the system. It helps by providing an overview of the primary objective of product functionality. These requirements will provide general information on both quantitative and qualitative properties to provide ease of integration and avoid discrepancies.

2.2.1 General

[FR1][s] The Wireless Home Security System package will include the following: one temperature sensor module, one motion sensor module, one flood sensor module, two wireless transceiver units, one user manual, and one CD containing the interface software. One wireless transceiver unit will be attached to a PC, and the other wireless transceiver will be attached to all sensor modules.

[FR2][s] The entire portable package consisting of one wireless transceiver and the appropriate circuitry shall be housed in a box measuring a maximum of 45 cm by 45 cm by 30 cm (length by width by height).

[FR3][s] The maximum distance is defined from the different maximum distances of each of the sensor modules. The temperature sensor, motion sensor, and flood sensor will have a maximum distance of 1 m, 5 m, and 7 m away from the transceiver, respectively.

2.2.2 Performance

[FR4][s] Maximum delay before a notification will be sent from a sensor to the PC is three seconds.

[FR5][s] Any sensor that has been reset will take a maximum of five seconds to become fully operational.

[FR6][h] WHSS will be able to use on-screen alerts, auditory sirens, e-mail, SMS messages, and phone calls to notify the user.

2.2.3 Compatibility and Regulatory

[FR7][h] No devices in the Wireless Home Security System shall cause interference with other wireless devices in the 900MHz/2.4GHz cordless phones and microwave ovens.

[FR8][s] No devices shall cause interference in the operation of the Wireless Home Security System.

[FR9][h] The wireless transceiver units, the controller circuit and the remote sensors shall rely on a standard power source for electricity (From 1.5VDC to 9VDC for the remote sensors and 110V AC for the wireless transceivers and the controller circuit).

[FR10][h] The wireless transceiver units are expected to comply with FCC Part 15.247 requirements for digital modulation [3]. The exact compliance with FCC requirements depends upon the protocol implemented by our system. Since the wireless transceivers shall only be utilized for a short period of time (three seconds), FCC compliancy should be maintained.

2.2.4 Reliability and Maintainability

[FR11][s] Sensors will send test messages every sixty seconds to the wireless transceiver, to ensure continuous functionality and working communication link with it.

[FR12][s] A sensor can be added, removed, or replaced for the WHSS provided the software program is terminated first. The addition/removal/replacement of a sensor will require additional hardware.

[FR13][h] When used with a battery source, the hardware module must have a low current draw to allow for the device to be used for at least three months before changing the battery.

3 Hardware Requirements

The rest of this section defines the features of the hardware pertaining to the needs of the user. Figure 2 below shows a general sketch of the hardware setup. Please note that some of the hardware requirements have already been covered in the previous section regarding the system requirements.

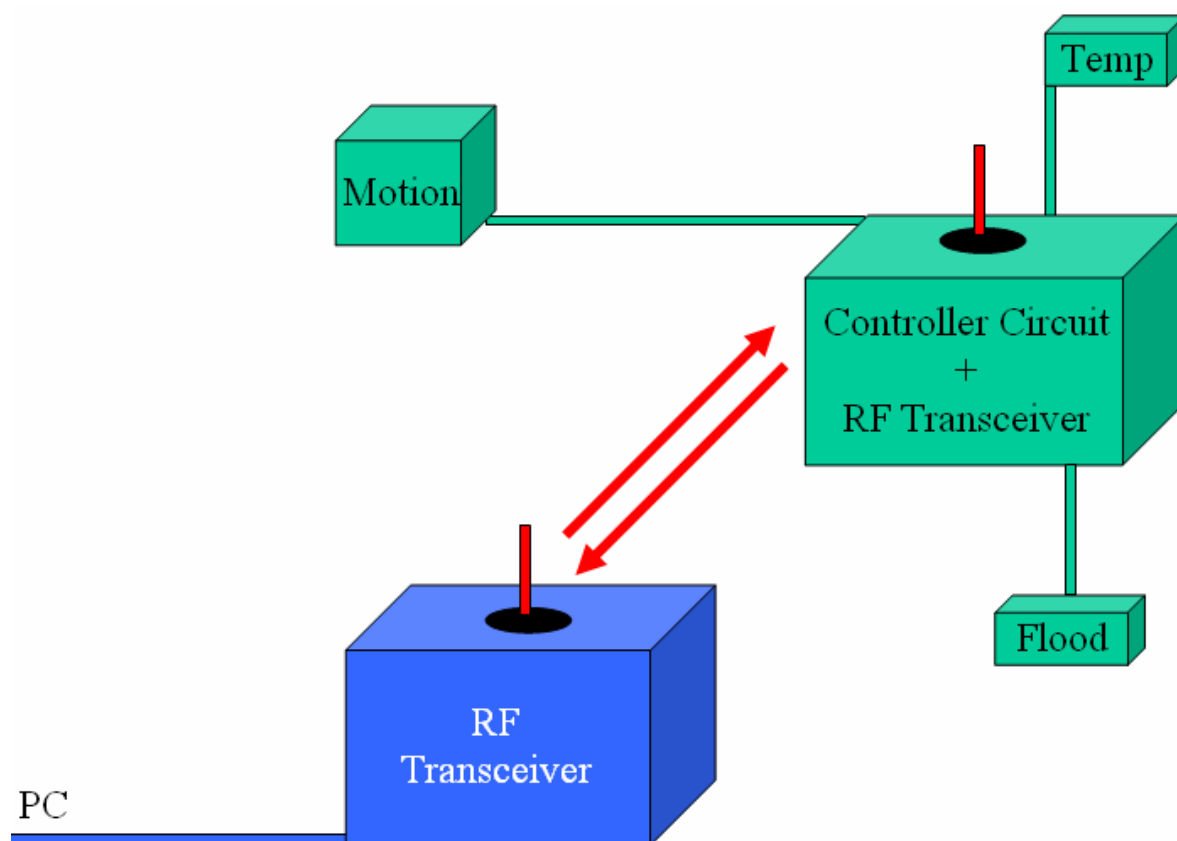


Figure 2: Physical sketch of the WHSS

3.1 Motion Sensor Module

In determining the requirements for the motion sensor module, the application primarily dictates what is required for the device. The following is a list of key requirements that have been identified for the motion sensor module:

3.1.1 Viewing Range

Viewing range is crucial for security systems since it allows detection for maximum area.

[FR14][h] The motion sensor shall have a horizontal sweep at least 100 degrees to ensure sufficient range for motion detection.

[FR15][h] The module shall be able to detect motion at least 50 meters away from it to ensure sufficient distance for motion detection.

3.1.2 Sensitivity

Sensitivity determines how sensitive the sensors are to certain stimuli in the external environment.

[FR16][h] The sensor module will provide accurate motion detection readings 90% of the time in which the device is in use. The probability of false alarms is 10% of the time in which the device is in use.

3.1.3 Temperature

[FR17][h] The sensor module shall be able to operate at temperatures between -10 and 40 degrees Celsius, which are the minimum and maximum contact temperatures for the human body before tissue failure [1].

3.1.4 Power Supply

Power is an important consideration, especially if the device is portable.

[FR18][h] An input voltage of between 1.5V to 9V will be drawn from the Controller Circuit.

3.2 Temperature Sensor Module

The selection of the temperature sensor module was based upon the following set of criteria to match the needs of the user:

3.2.1 Temperature Range

[FR19][h] The temperature sensor will be suitable for monitoring extreme temperature conditions. The lowest contact temperature for the human body is -10 degrees Celsius and the highest contact

temperature is 40 degrees Celsius before tissue damage [1]. The temperature range of the device shall cover a wider range of temperatures than the contact temperatures.

3.2.2 Power Supply

FR20][h] To ensure the portability of the temperature sensor module, the power consumption of the unit would be low in order to minimize battery usage. The battery voltage supply shall be between 1.5VDC and 9VDC.

3.2.3 Size

FR21][h] The temperature sensor module will be compact such that the module may be placed in confined locations in a household. The maximum size will be 3 cm by 5 cm by 4 cm (length by width by height).

3.2.4 Weight

FR22][h] The unit shall be lightweight for it to be portable. The weight would be a maximum of 50 grams.

3.3 Flood Sensor Module

The following sets of requirements pertain to the functionality of the flood sensor module.

3.3.1 Portability

FR23][h] The module shall be carried without any attachments that prevent it from being moved (i.e. power cords). Therefore, the module must use a battery for portability.

3.3.2 Power Supply

FR24][h] The power for the module shall be obtained from the Controller Circuit with a voltage range of 1.5VDC to 9VDC to ensure that combinations of standard battery types can be used (combinations of AA, AAA, 9 Volt, C or D size batteries).

3.3.3 Size

FR25][h] Size shall be conformed to the following maximum dimensions: 5 cm by 5 cm by 3 cm (length by width by height).

3.3.4 Weight

FR26][h] To ensure that the module is portable, it must be lightweight. The weight for this module must not exceed 50 grams.

3.3.5 Safety

[FR27][h] Since this module comes in contact with water, it must be safe such that it shall not cause electrical harm to the user.

4 Software Requirements

The role of the user, when at the computer, is to be able to test the sensors, as well as check on their status and past events. When away from the computer, if an alert is detected, the user can elect whether to contact authorities or to simply ignore it. Any SMS or phone call alerts to the user will be received on his/her cell phone, possibly with a special ring tone or other message. Any e-mail messages are expected to be sent with a high priority rating.

At the computer, the program is based on a graphical user interface that runs similar to other mainstream Windows programs.

The rest of this section defines what the user will be able to do with the software, as well as the user-visible actions. The prefix codes are defined as in section 1.3.

[FR28][s] The user software should run on most PCs. Minimum hardware requirements are a Pentium 1 or equivalent CPU with 16 MB RAM running Windows 95 or later. This should make hardware requirements a non-issue.

[FR29][s] The PC should have a communications port, which will connect the PC with the RF transceiver unit.

[FR30][s] The software should take no more than 1 MB of system memory while it is running in any mode, so it does not impede the operation of other applications.

4.1 User Input and Operations Requirements

[FR31][h] The only user inputs required to run and configure the program will be the keyboard and the mouse.

[FR32][s] For full functionality, a working mobile telephone and other place to receive e-mail is recommended, so the user can be notified.

4.2 Security Requirements

[FR33][h] Users must log in with a user name and password through the interface, before any of the sensors can be turned on or off, to reduce tampering.

4.3 Activity Logging Requirements

[FR34][h] All events will be recorded in an activity log file, so the user and/or authorities can track down any possible issues.

[FR35][s] All notifications will be recorded in an activity log file with an asterisk prefix (*), since they are of higher importance.

4.4 Communications Requirements (SMTP/SMS functionality)

[FR36][h] The program will be capable of sending e-mail to a user-selected e-mail address in the event of an intrusion, assuming the user has a broadband Internet connection with working e-mail settings.

[FR37][t] If no broadband connection exists, the program will use a dial-up modem (based on the user's home phone connection) and their Internet Service Provider to send the e-mail, assuming both of these entities exist.

[FR38][s] The program will be capable of sending SMS messages to a user-selected phone number (via e-mail).

[FR39][s] The program will be capable of calling a user-selected phone number to deliver a user-definable voice message.

[FR40][s] A priority list of contact methods will be defined by the user (e.g. first priority can be voice call, followed by SMS, etc), so if one method fails to perform properly, the next alternative can be used.

4.5 Installation

[FR41][h] An installation of the software will be required. The installation should be done under Windows administrative login.

[FR42][h] The user will only be required to install the software a single time (assuming no re-installations of Windows).

[FR43][h] Installation of the software will take less than 5 minutes.

[FR44][h] After installation, it will be possible to call the program from the Windows Start menu.

[FR45][s] The program will take less than 10 seconds to be idle after startup.

[FR46][h] It will be possible to uninstall the program via either "Add/Remove Programs" in "Control Panel", or via a separate un-installation program.

4.6 Documentation Requirements

[FR47][h] A 10-page (letter-sized) user manual detailing features and functionality of the software is expected to be completed by April 2005.

[FR48][h] The user manual will include basic operating instructions and a troubleshooting section.

4.7 Activity Logs

[FR49][h] The activity log file can be conveniently viewed within the program.

[FR50][s] This log file can be exported to another text-based format, or printed on paper.

[FR51][s] Any report of a malfunctioning sensor will be treated as an notification and the user will be notified by priority list.

5 Conclusion

The functional specifications described in this document pertaining to the WINnovations Wireless Home Security System have been outlined in detail and provide an accurate as possible representation of the product in the preliminary analysis for this project. The specifications will provide a useful reference for the design phase of the project as well as provide a layout of the requirements that are applicable to the security system. In addition to considering the qualitative and quantitative values associated with each requirement, consideration has been made for usability to provide optimal functionality.

6 Glossary

Event – A change in the status of any one of the sensors, with the only exceptions for miniscule temperature changes within the sensors' safe range (0.1 degree differences that are within the sensors' safe range).

Intrusion – An event serious enough to warrant notifying the user as soon as possible.

SMS – Short Message Service – A method of sending text messages to mobile phones.

7 References

- [1] <http://regulation.healthandsafetycentre.org/s/GuidelinePart4.asp?ReportID=18787>
- [2] Proposal for a Wireless Home Security System, WINnovations
- [3] <http://www.beagle-ears.com/lars/engineer/wireless/fccrules.htm>