
System Requirements Document for Safe Home

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Version	Date	Author	Change
0.1	12/02/04	All	Initial Document
1	12/05/04	All	Section 3
2	12/12/04	All	Use cases, Interfaces, revision
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1 Introduction

Dr. Chang and Dr. Wong proposed the Smart Home Project (SHP) to the COM S 409X/509X students in October 2004 by Dr. Chang and Dr. Wong to develop the vision and requirements for a SHP lab environment. The tasks for the COM S 409X/509X students are to develop the vision and requirements documents for the project, which are to be delivered to the Computer Science Department by the December 17, 2004.

1.1 PURPOSE

This Software Requirements Specification (SRS) provides a description of all the functions, specifications, external behaviors, design constraints, requirements (function and non-functional) and other factors necessary to provide a complete and comprehensive description of the proposed SHP.

This document is written primarily for the Computer Science Department faculty involved in the SHP: Dr. S. Mitra, Dr. J. Wong, and Dr. C. Chang. Further audiences for this document are the remaining stakeholders, such as the developers, programmers, integrators and maintainers of the proposed system.

1.2 SCOPE

The scope of the SHP is to create a prototype SHP environment for the Computer Science Department of Iowa State University located in Atanasoff 126. This prototype shall be used to further develop the SHP, as well as initiate interest in smart home research at Iowa State University. The SHP lab is a full-sized, interactive environment that incorporates technology to assist in Activities of Daily Living (ADLs) and is subject to the regulations and constraints placed on the system by Iowa State University, the Department of Computer Science.

1.3 DEFINITIONS, ACRONYMS, ABBREVIATIONS

Term	Description
ADLs	Activities of Daily Living
ALF	Assisted Living Free

Customer	The end user group whose members include senior and disabled persons
Developer	The intermediate user group whose members include faculty and students from the Computer Science Department
ILSA	Independent LifeStyle Assistant
JVM	Java Virtual Machine
Linux	A freely-distributed open source operating system
RFID	Radio Frequency Identification
Roller ball mouse	Standard track ball or optical mouse
SHP	Safe Home Project
SRS	Software Requirements Specification
Traditional	Functioning as if the system did not exist
USB	Universal Serial Bus
Windows XP	An operating system introduced in 2001 from Microsoft's Windows family of operating systems

1.4 REFERENCES

- [1] Climans, Renee, Elsa Marziali, Arlene Clonsky, and Lesley Patterson. "Computer Interface Modifications for Training Elderly Users to Access the Internet." Bell University Laboratories. 14 December 2004. <<http://bul.med.utoronto.ca/project4.html>>.
- [2] "Cubicles." 6 July 2004. Eurocare Showers LTD. 14 December 2004. <<http://www.eurocareshowers.com/cubicles.htm>>.
- [3] GigaNano. "Automatic Monitored Pill Dispenser." 2004. e-pill, LLC. 14 December 2004. <<http://www.epill.com/md2.html>>.
- [4] "Rotoflex." Theraposture. 14 December 2004. <<http://www.theraposture.com/Rotoflex.htm>>.
- [5] "Washlet C100." 2002. TOTO USA, Inc. 14 December 2004. <<http://www.washlet.com/chloe.asp>>

1.5 OVERVIEW

[OMIT]

2 Overall Description

The SHP shall be a prototype of an assisted living home, where technology is the main form of assistance. In addition to creating an environment to aid in ADLs, courses and researchers shall have the opportunity to use the system as a tool. Students shall gain experience during the creation and evolution of the project. Incorporated into the system design shall be a means to provide information about the behavior and use of the technology.

2.1 PRODUCT PERSPECTIVE

2.1.1.1 Assisted Living Facilities:

Assisted living facilities are for persons that need assistance with ADLs but wish to live as independently as possible. Most assisted living facilities create a detailed service plan for individual residents upon admission, which is updated regularly to assure that the resident receives the appropriate care as his or her condition changes. These services include help preparing meals, bathing, dressing, performing household chores, and aid for persons confused or experience memory problems. Other common terms for assisted living are residential care, personal care, adult congregate living care and supported care.²

2.1.1.2 Nursing Homes:

Nursing homes provide skilled nursing care and rehabilitation services to people with illnesses, injuries or functional disabilities. Even though most facilities serve the elderly, some facilities provide services to younger individuals with special needs, such as the developmentally disabled, mentally ill, and those needing drug and alcohol rehabilitation. Nursing homes are generally stand-alone facilities, focusing their attention on rehabilitation, so that their residents can return to their own homes as soon as possible. Some of the services provided by nursing homes include therapies, pharmacy services, and specialty care, such as Alzheimer's treatment, neuromuscular diseases, stroke recovery.³

2.1.1.3 University of Florida:

“The RERC-Tech-Aging is testing currently available home monitoring products relative to their effectiveness in relation to independence, quality of life and health related costs. The RERC-Tech-

Aging is also identifying needs and barriers to home monitoring and communication technology, and addressing needs of special populations including rural-living elders, and people aging with disability. The results of this research will be relevant to health policy makers, device developers, and other investigators. The RERC-Tech-Aging works with companies on pre-product testing, including Honeywell's very promising Independent LifeStyle Assistant (ILSA). We are advancing very new consumer products such as Motorola's Smart Phone, to provide applications useful for older people with disabilities. We are also studying the requirements for, and development of a device / system for elders with cognitive impairment. We are applying the concept of pervasive computing to the needs of older persons through our work with smart phones and smart homes.”⁴

2.1.1.4 Niagara Framework:

The Niagara Framework, developed by Tridium Software, is a Java-based framework that allows development of smart homes using different components from different manufactures. Niagara was developed using JavaBeans that allows every component to be treated as an object. Niagara uses an adapter development pattern so that every object, regardless of manufacture, communication standard, or software can run from a standard web browser. The framework can then dictate to each device what needs to be done its own protocol, thus saving time that would be used to program all devices. The framework operates on a wide variety of hardware platforms and operating systems due to Java development. The Niagara Framework differs from the project vision since the framework is designed primarily for an electronic house, not necessarily a smart home.⁵

2.1.2 Concept of Operations

The customer side of SHP shall work as a request driven application. The customer will request that the SHP perform an action such as “turn on lights,” then the system will respond appropriately. The system shall automate tasks through requests generated through the configuration of the SHP. In general, the system shall act as an intermediary between the customer and the device without interfering with the normal operation of the device.

The developer side of the SHP shall work as a research and development environment to learn and research new techniques for the development and implementation of a SHP environment. These goals shall be accomplished by treating the SHP as an ongoing project which focuses on real

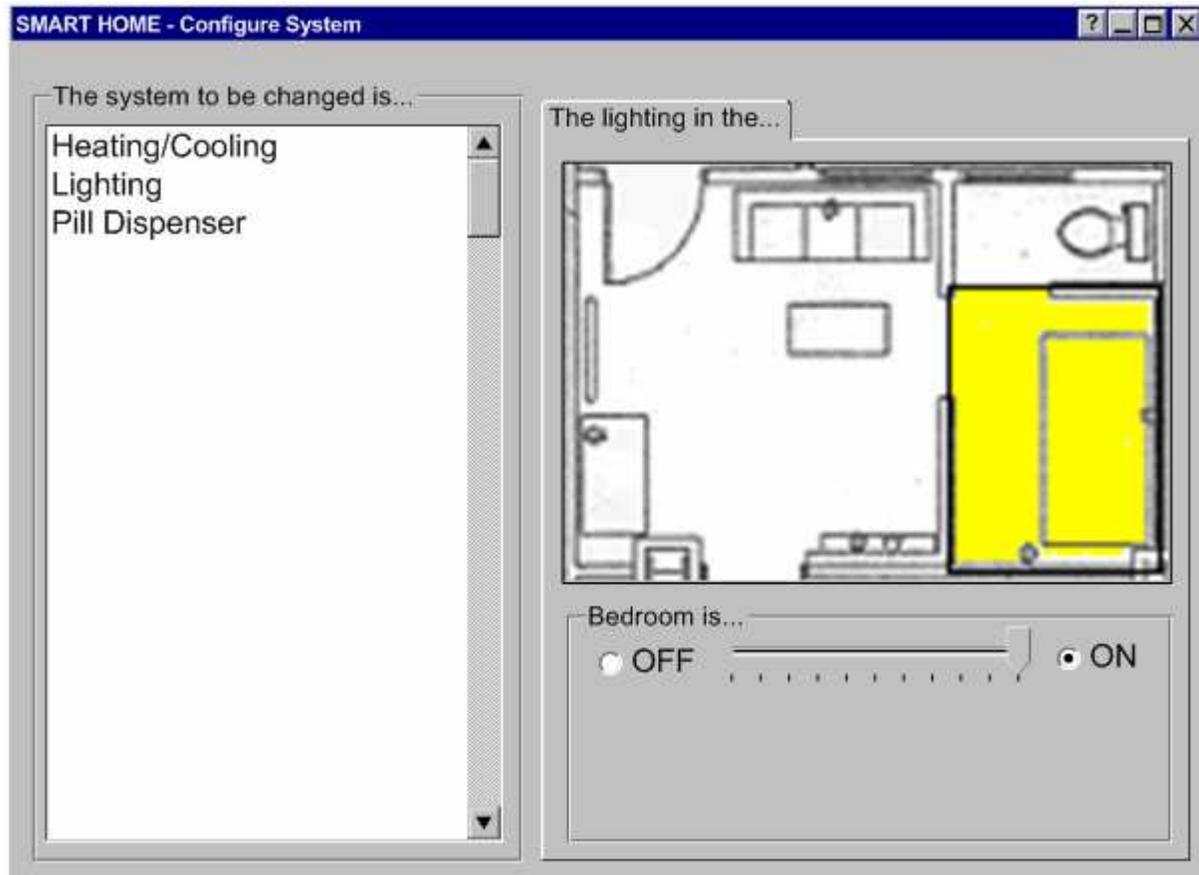
customer needs, following through on the plans, and gathering the usage data. The SHP shall gather data by monitoring the uses of the system by the customer then recording this information into a database. This information will then assist the developers to base future iterations off previous usage requirements.

2.1.3 Major User Interfaces

The overall screen flow diagram of the proposed SHP customer workstation application can be found in Appendix A. The developer application is described in the framework requirements documentation. In addition, voice and mobile devices will emulate this general flow and layout when possible. This diagram displays most of the screens containing the functionality of the SHP customer application. As seen in the screen flow diagram, the view of the system's functionality is partitioned into three main sections based on general use type of configuration of the system, communication interfaces, and cooking assistance. Then, depending on the type of user, a series of screens are possible. This diagram only shows the potential flows of the SHP customer workstation application. The following subsections give representative screenshot and brief descriptions of some of the more important screens of the SHP customer workstation application.

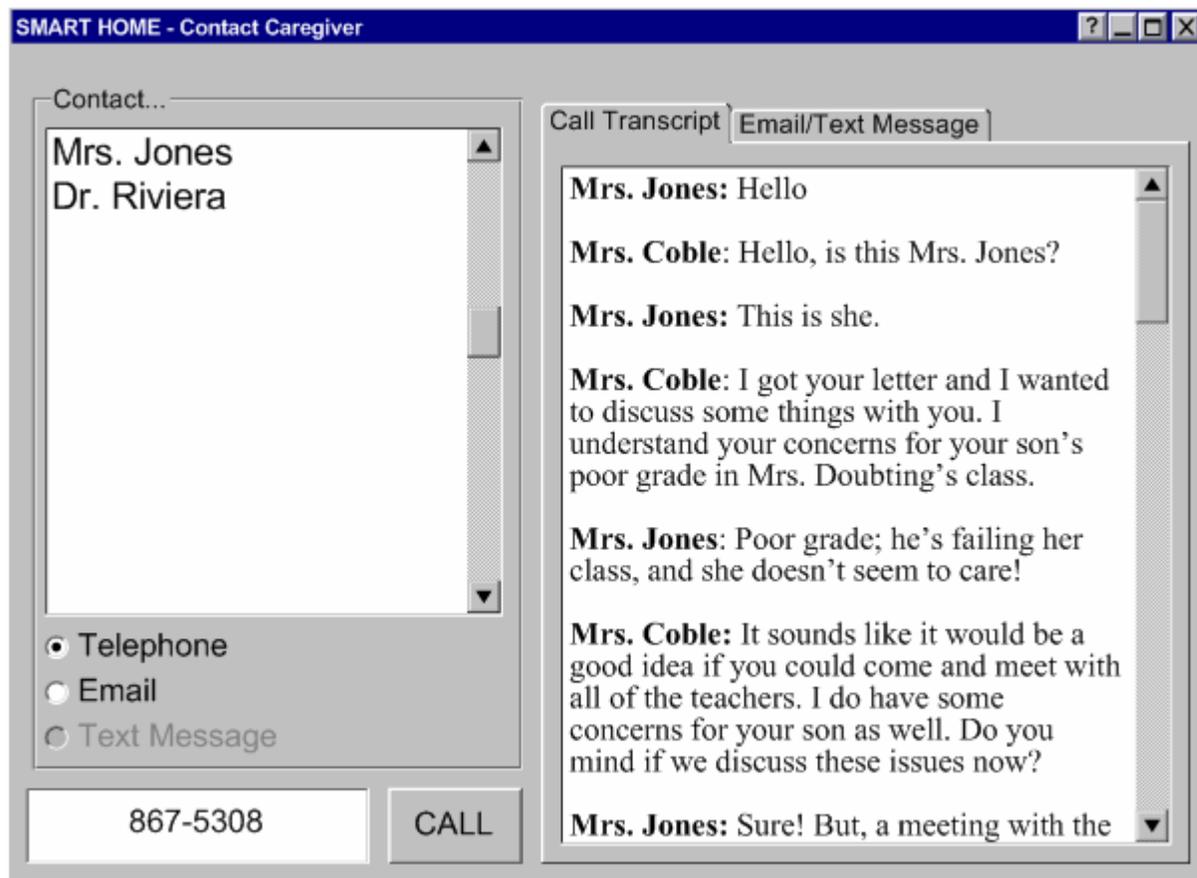
2.1.3.1 Example Screenshot and description

2.1.3.1.1 The interface shall allow the environment to be adjusted through workstation control.



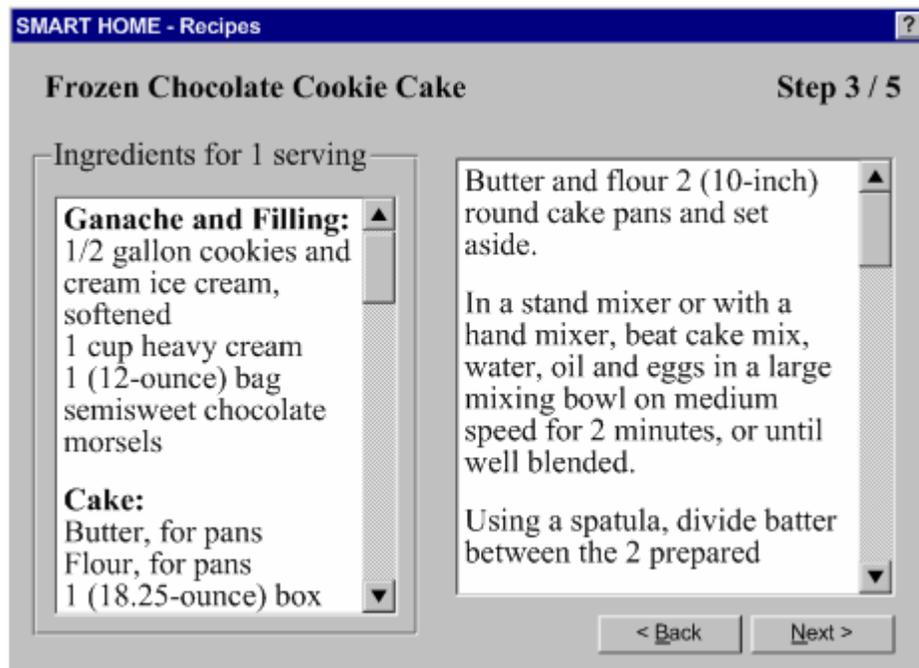
This screen is a prototype of how the configuration tool will work. Options available in this general format are the following: lights, heating/cooling, pill dispenser, security, maintenance, cooking, and communication. Additionally, the option to create timers or automatic functions would be located as an option as well.

2.1.3.1.2 The interface shall allow a variety of communications.



This screen is a general design for a communication screen that allows the customer to select the method and person then perform the connection. A mirror image of this screen allows the customer to view old transcripts of all the communications by selecting the method and person then viewing the transcript.

2.1.3.1.3 The SHP customer application shall display a walk through for food preparation.



The interface displays the number of people the food is being prepared for as well as instructions broken down into steps.

2.1.3.1.4 The SHP shall have motion sensors, microphones, and smoke detectors that shall provide input.

The diagram of sensor locations can be found in Appendix B.

2.1.4 Hardware Interfaces

2.1.4.1 Workstation

2.1.4.1.1 Customer workstation shall have keyboard input.

2.1.4.1.2 Customer workstation shall have roller ball mouse input.

2.1.4.1.3 Customer workstation shall have minimally a 19-inch monitor.

2.1.4.1.4 All interfaces on customer workstation shall be scaleable in information display size.

2.1.4.1.5 Customer workstation shall have appropriate hardware for network connection.

2.1.4.1.6 Optionally, the customer workstation shall have speakers for sound if any responses are done aurally through the workstation.

2.1.4.2 Mobile Device

2.1.4.2.1 Customer mobile device shall use its pre-existing hardware interfaces such as USB connection, network connection, or other features as applicable to the product.

2.1.4.3 X-10

2.1.4.3.1 System shall provide x-10 controllers to be integrated with framework.

2.1.4.4 Sensors

2.1.4.4.1 System shall accept input signals from smoke detectors.

2.1.4.4.2 System shall accept input signals from motion sensors.

2.1.4.4.3 System shall accept input signals from microphones.

2.1.5 Software Interfaces

2.1.5.1 Customer workstation shall have the latest Java Virtual Machine (JVM) installed.

2.1.5.2 Customer workstation shall be internet capable with at least one internet browser available.

2.1.5.3 Customer mobile device shall be internet capable with an internet browser.

2.1.6 Communication Interfaces

2.1.6.1 Customer workstation shall be connected to the local development network.

2.1.6.2 Customer workstation shall be internet capable.

2.1.6.3 Customer workstation shall have USB connection slots available.

2.1.6.4 System shall connect with the telephone lines.

2.1.7 Memory Constraints

2.1.7.1 Customer workstation shall have at minimum 128 MB of RAM.

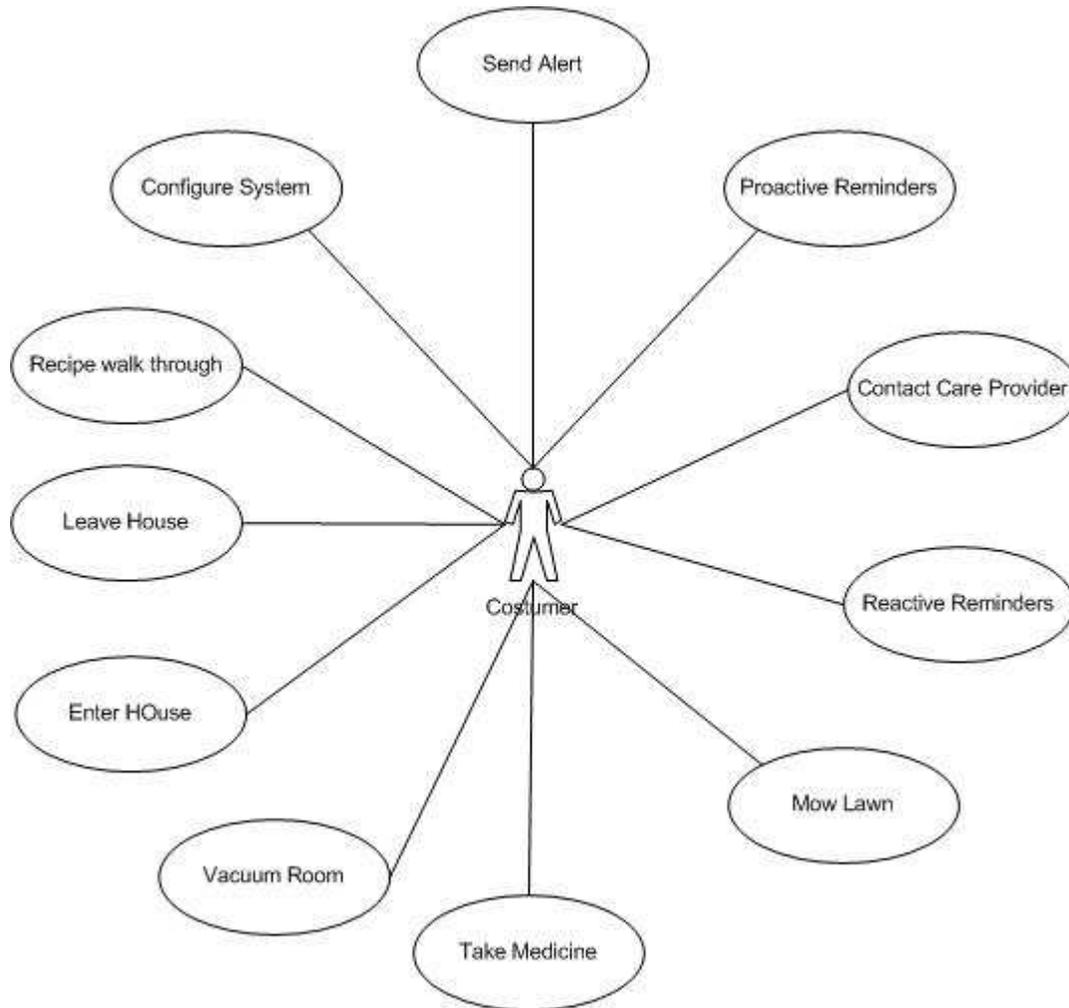
2.1.8 Operations

[None]

2.1.9 Site Adaptation Requirements

2.1.9.1 In future iterations of the SHP, the system shall support internationalization of language and regulations.

2.2 PRODUCT FUNCTIONS



2.2.1 Configure system

Title: Configure System

Description: User wants to change a setting for a safe home controlled device.

Actor: Customer

Preconditions: System is on with at least one user specified.

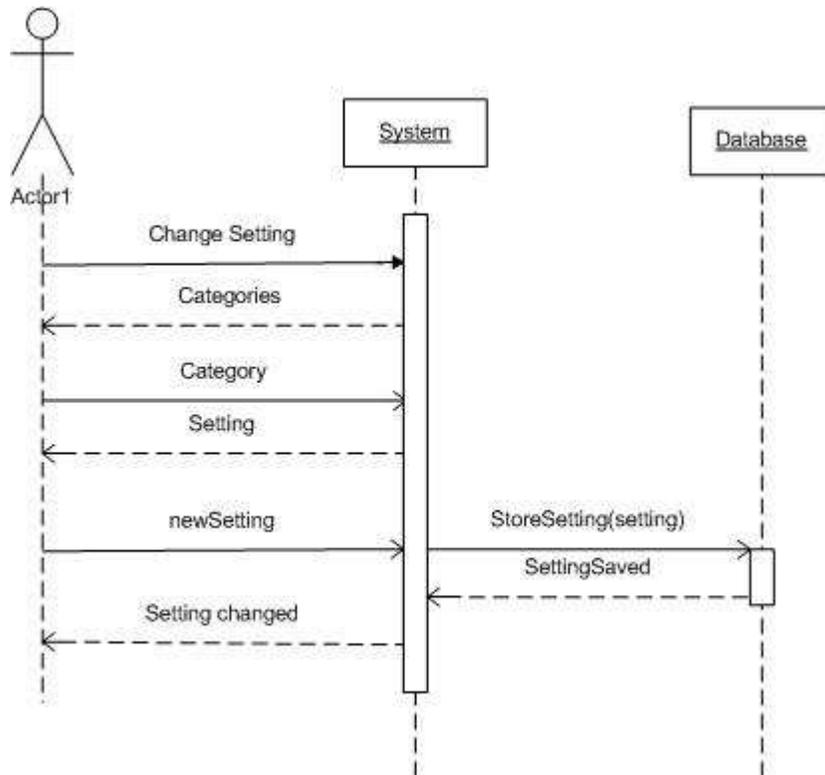
Post conditions: System has saved new setting for device.

Basic flow:

- 1) The customer informs system that the user wants to change a setting.
- 2) System lists configurable categories for the customer.
- 3) The customer selects category to be changed.
- 4) System prompts customer for new configuration of setting.
- 5) The customer provides new configuration
- 6) System changes configuration, and saves the setting.

Alternate:

- 1) In the future, the system shall learn from change of setting to change automatically the setting based on common usage.



2.2.2 Send Alert

Title: Send Alert

Description: System detects an emergency, sends an alert to the correct authority and primary caregiver.

Actor: Customer

Preconditions: System and its sensors are monitoring User and home conditions.

Post conditions: System has notified the correct authority and the primary caregiver about emergency.

Basic flow:

- 1) The system detects health emergency
- 2) The system asks the customer if the user needs assistance.
- 3) The customer tells the system to send an alert
- 4) The system notifies local authorities and primary caregiver that the customer needs assistance.
- 5) The system notifies the customer that authorities have been notified.

Alternate:

1a) Utilities Emergency

- 1) The system detects utilities emergency
- 2) The system asks if the customer needs assistance
- 3) The customer informs the system to send alert.
- 4) The system notifies correct utility company and primary caregiver that the customer needs assistance
- 5) The system notifies the customer that authorities have been notified.

1b) Environmental Emergency

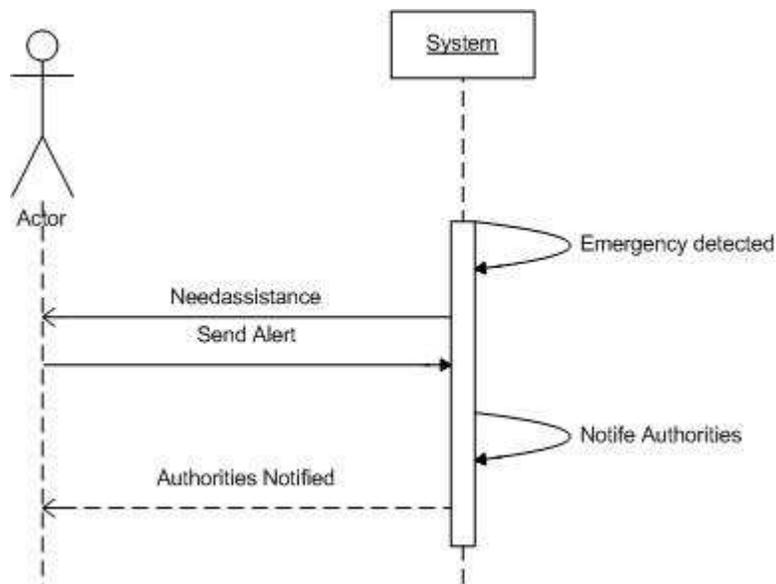
- 1) The system detects environmental emergency
- 2) The system asks if the customer needs assistance
- 3) The customer informs the system to send alert
- 4) The system notifies local authorities and primary caregiver that the customer needs assistance.
- 5) The system notifies the customer that authorities have been notified.

3a) Customer informs the system not to send an alert

- 1) The system continues to monitor emergency.
- 2) The system re-alerts if no action is taken.

3b) Customer does not respond to the system.

- 1) The system notifies local authorities and primary caregiver.



2.2.3 Proactive reminders

Title: Proactive reminders

Description: User System detects variances from user-defined settings such as open windows, or lights on, etc.

Actor: Customer

Preconditions: System is on and is monitoring the user and its sensors.

Post conditions: System has detected a variance and alerted the user to its presence.

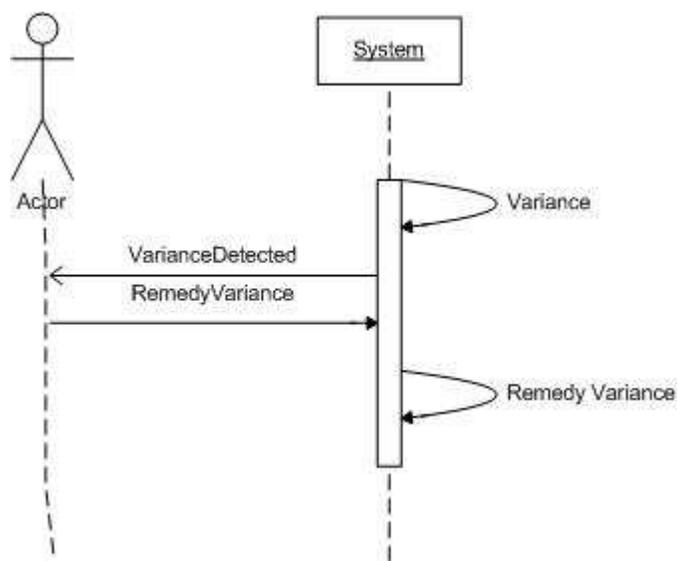
Basic flow:

- 1) The system detects variance from user specified settings.
- 2) The system notifies the customer of variance.
- 3) The system asks if the customer wants variance remedied
- 4) The customer informs the system to remedy variance
- 5) The system remedies variance.

Alternate:

3a) Customer does not want to remedy variance

- 1) The system continues to monitor variance, but does not remind again.



2.2.4 Reactive reminders

Title: Reactive reminders

Description: System detects a hazard that may cause the user harm.

Actor: Customer

Preconditions: System is on and is monitoring the user and its sensors.

Post conditions: System has notified user of hazard and has either remedied the situation, notified primary caregiver of situation, or is monitoring the hazard to ensure user takes care of it.

Basic flow:

- 1) The system detects hazard.
- 2) The system notifies the customer of hazard
- 3) The system asks the customer if the he/she would like to fix hazard.
- 4) The customer instructs the system to fix hazard.
- 5) System fixes hazard.

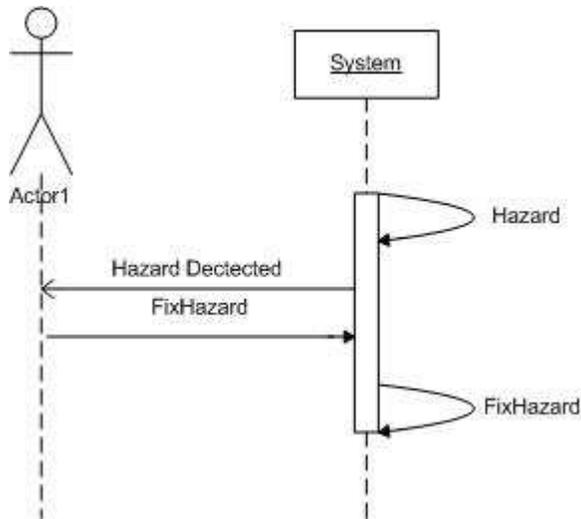
Alternate:

5a) System cannot fix hazard

- 1) The system notifies the customer that it cannot fix hazard.
- 2) The system notifies primary caregiver of hazard.

4a) User does not want system to fix hazard.

- 1) The system continues to monitor hazard.
- 2) The system reminds the customer again if no action is taken.



2.2.5 Take Medicine

Title: Take Medicine

Description: User needs to take a dosage of medicine.

Actor: Customer

Preconditions: System is on and has medicine available for User.

Post conditions: User has taken dosage and system stores that medicine has been taken and what time it was taken.

Basic flow:

- 1) The customer informs the system that he/she would like to take his/her medicine.
- 2) The system shall identify the customer.
- 3) The system provides the customer with proper dosage of medicine
- 4) The system stores that the medicine was taken, the amount taken, and the time taken.

Alternate:

- 1) System alerts the customer to take medicine

2.2.6 Vacuum room

Title: Vacuum room

Description: User System tells vacuum to vacuum a room.

Actor: Customer

Preconditions: System is on and vacuum is available for use.

Post conditions: System has vacuumed a room and vacuum return to docking bay.

Basic flow:

- 1) The customer instructs the system to vacuum a room.
- 2) The system starts the vacuum and informs it what room to vacuum.
- 3) The vacuum returns to docking bay when finished
- 4) The system notifies the customer that vacuuming is completed

Alternate:

None

2.2.7 Mow Lawn

Title: Mow Lawn

Description: System tells mower to mow the lawn.

Actor: Customer

Preconditions: System is on and mower is available.

Post conditions: System has mowed the lawn and mower returned to docking bay.

Basic flow:

- 1) The customer instructs the system to mow lawn.
- 2) The system starts lawn mower.
- 3) The lawn mower returns to its docking bay when finished

4) The system notifies the customer that lawn is mowed.

Alternate:

None

2.2.8 Contact caregiver

Title: Contact caregiver

Description: System contacts a caregiver for user.

Actor: Customer

Preconditions: System is on and has a list of caregiver with contact information.

Post conditions: System has contacted the specified caregiver for User.

Basic flow:

- 1) The customer instructs the system to notify a caregiver
- 2) The system asks for caregiver name.
- 3) The customer provides a caregiver's name.
- 4) The system asks for type of communication.
- 5) The customer provides type of communication.
- 6) The system asks for message.
- 7) The customer provides message to recipient.
- 8) The system sends message through contact information.

Alternate:

3a) The costumer gives a caregiver name that is not available or has no contact information.

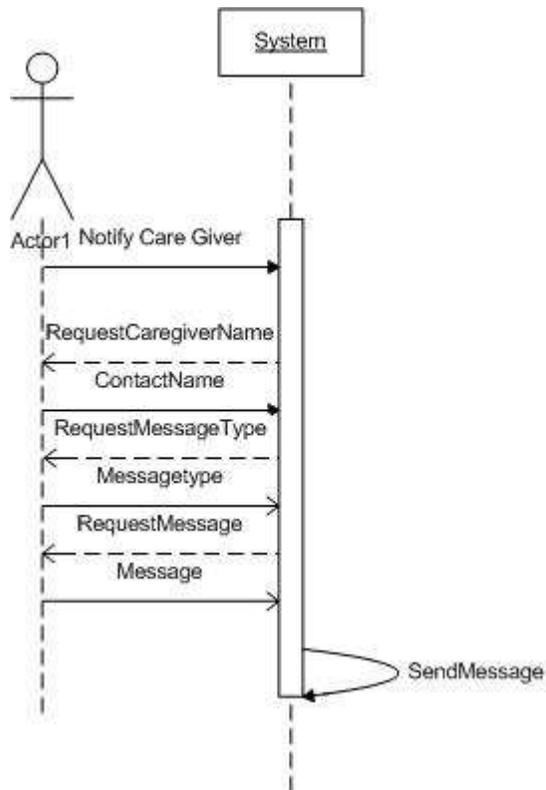
2) The system asks for caregiver name.

....

3b) The costumer requests a list of names within a subset, i.e. doctors, nurses, family, friends

- 1) The system provides a list of all contacts within subset.
- 2) The costumer selects a caregiver.
- 4) The system asks for type of communication.

...



2.2.9 Leave House

Title: Leave House

Description: System changes all setting to vacant mode.

Actor: Customer

Preconditions: System is on and user has vacant mode setting.

Post conditions: User is out of the house and the system is in vacant mode. All communication is going to Users wireless devices.

Basic flow:

- 1) The system detects the customer leaving Smart Home.
- 2) The system changes all settings to vacant mode.
- 3) The system changes all monitoring and communications to wireless devices.

Alternate:

None

2.2.10 Enter House

Title: Enter House

Description: System changes settings back to pre-vacant status.

Actor: Customer

Preconditions: System is on and is in vacant mode.

Post conditions: System is back to pre-vacant setting.

Basic flow:

- 1) The system detects the customer entering the Smart Home.
- 2) The system raises lights and changes settings back to pre-vacant status.
- 3) The system resumes monitoring and communication and retrieves all information stored in wireless devices.

Alternate:

None

2.2.11 Recipe Walk Through

Title: Recipe walk through

Description: User System provides user with recipe instructions for a meal.

Actor: Customer

Preconditions: System is on and recipes are preprogrammed in. All cooking utensils are ready and working properly.

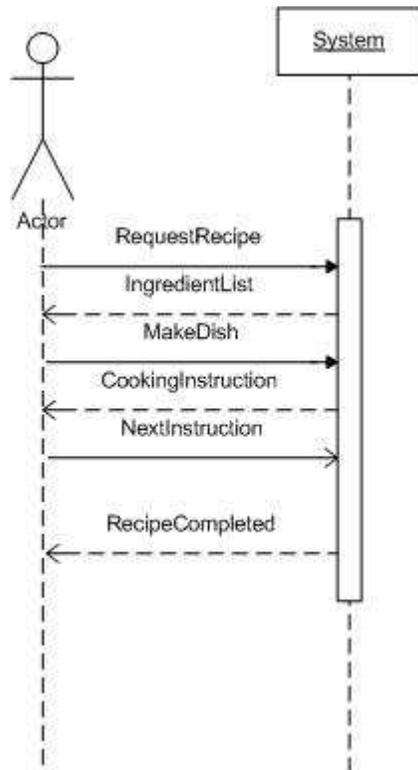
Post conditions: All Recipe steps are done and meal is ready.

Basic flow:

- 1) The customer selects to make dish.
- 2) The customer selects number of servings
- 3) The system informs the customer of a step to make dish.
- 4) The customer completes step and prompts the system for next step.
- 5) The system notifies the customer when all step have been completed

Alternate:

None



2.3 USER CHARACTERISTICS

2.3.1 User/market demographics

2.3.1.1 (Networking and Systems) Researchers:

2.3.1.1.1 Researchers for the SHP shall primarily consist of Iowa State University Computer Science faculty interested in networking and systems; research assistants shall be primarily upperclassmen from the Computer Science department.

2.3.1.2 Assisted Living Residents:

2.3.1.2.1 According to the National Center for Assisted Living's 2000 Survey of Assisted Living Facilities, the typical assisted living resident is an 80-year-old woman who is mobile, but requires assistance with approximately two ADLs. Sixty-nine percent of the residents are female; 31 percent are male. The average age of a resident is 80-years-old, ranging from 60-years-old, as the average youngest, to 94-years-old, as the average oldest. Nineteen percent of assisted living residents need no help in taking care of ADLs; others need help varying degrees. On average, assisted living residents need help with 2.25 ADLs.

Personal Activities	Independent	Some Help	Dependent
Bathing	28%	42%	30%
Dressing	43%	33%	24%
Transferring	64%	19%	17%
Toileting	58%	22%	19%
Eating	77%	13%	10%

Table 1: Activities of daily living and the levels of assistance residents require

Ninety-three percent of assisted living residents need or accept help with housework, while 86% need or accept help with their daily medication.¹

2.3.2 User Environment

2.3.2.1 The environment is split into three sections: Developers Area, Closed Lab, and Smart Home. The layout, dimensions, key items are provided in Figure 1.

2.3.2.2 Developers Area

2.3.2.2.1 This section shall consist of workstations for the developers and researchers.

2.3.2.2.2 There shall be 10 computers running Linux and 10 computers running the Windows XP.

2.3.2.3 Closed Lab

2.3.2.3.1 The closed lab section will be a locked location where the Solaris server is stored.

2.3.2.4 Smart Home

2.3.2.4.1 The smart home section will consist of three 'rooms': a small bathroom, bedroom, and living room.

2.3.2.4.2 There will be only openings between these 'rooms'.

2.3.3 Key User Needs

2.3.3.1 (Networking and Systems) Researchers:

2.3.3.1.1 Data collection for research analysis

2.3.3.2 Easy device integration

2.3.3.2.1 Assisted Living Residents:

2.3.3.2.2 Non-critical medical assistance, such as medication reminders and heartbeat monitors

2.3.3.2.3 ADLs assistance dependent upon resident condition

2.3.3.2.4 To live as independently as possible

2.3.3.3 Social interaction

2.4 CONSTRAINTS

2.4.1 Budget constraints are a limitation since physical items, such as the networking equipment, servers, furniture, and appliances, must be purchased.

2.4.2 Expert knowledge and quality control are limitations, for the reason that without a definitive expert on assisted living, or assisted living through technology, all knowledge is subject to student research.

2.4.3 Time is a limitation because development the initial requirements and framework development are done as course projects, which will thus be measured on a semester scale.

2.4.4 In addition to time constraints, the students using the SHP as a course tool shall be subject to a potential high learning curve for the project environment.

2.5 ASSUMPTIONS AND DEPENDENCIES

2.5.1 Every user in the house portion of the lab shall wear a unique RFID tag.

3 Specific Requirements

3.1 EXTERNAL INTERFACE REQUIREMENTS

3.1.1 User Interfaces

3.1.1.1 Workstation

3.1.1.1.1 The SHP shall create a customer application to control the functionality of the SHP.

3.1.1.1.2 The classes of customer user interfaces are configuration, communication, and cooking. More details and screen shots of these are in section 2.1.3 Major User Interfaces.

3.1.1.2 Mobile Device

3.1.1.2.1 The customer application shall be ported to customer's mobile device.

3.1.1.3 Aural interface

3.1.1.3.1 The customer shall be able to interface with the system through voice commands.

3.1.1.3.2 Information on voice input features can be found at 3.1.2.3.

3.1.2 Hardware Interfaces

3.1.2.1 Workstation

3.1.2.1.1 Customer workstation shall have keyboard input.

3.1.2.1.2 Customer workstation shall have roller ball mouse input.

3.1.2.1.3 Customer workstation shall have minimally a 19-inch monitor.

3.1.2.1.4 All interfaces on customer workstation shall be scaleable in information display size.

3.1.2.1.5 Customer workstation shall have appropriate hardware for network connection.

3.1.2.1.6 Optionally, the customer workstation shall have speakers for sound if any responses are done aurally through the workstation.

3.1.2.2 Mobile Device

3.1.2.2.1 Customer mobile device shall use its pre-existing hardware interfaces such as USB connection, network connection, or other features as applicable to the product.

3.1.2.3 X-10

3.1.2.3.1 System shall provide x-10 controllers to be integrated with framework.

3.1.2.4 Sensors

3.1.2.4.1 System shall accept input signals from smoke detectors.

3.1.2.4.2 System shall accept input signals from motion sensors.

3.1.2.4.3 System shall accept input signals from microphones.

3.1.3 Software Interfaces

3.1.3.1 Customer workstation shall have the latest Java Virtual Machine (JVM) installed.

3.1.3.2 Customer workstation shall be internet capable with at least one internet browser available.

3.1.3.3 Customer mobile device shall be internet capable with an internet browser.

3.1.4 Communications Interfaces

3.1.4.1 Customer workstation shall be connected to the local development network.

3.1.4.2 Customer workstation shall be internet capable.

3.1.4.3 Customer workstation shall have USB connection slots available.

3.1.4.4 System shall connect with the telephone lines.

3.2 FEATURES

3.2.1 Interfacing features

3.2.1.1 Workstation input feature [1].

3.2.1.1.1 User shall interact with the workstation via mouse and or keyboard.

3.2.1.1.2 System shall have large lettered keyboards.

3.2.1.1.3 System shall have roller ball mouse.

3.2.1.2 Mobile Device input features

3.2.1.2.1 System shall mimic standard input functioning of the particular style of device.

3.2.1.3 Voice Input features

3.2.1.3.1 Costumer shall prompt the system before any command is given.

3.2.1.3.2 The system shall not respond to words from inter-personal conversation.

3.2.1.3.3 The system shall not respond to voice commands from white noise media.

3.2.1.4 Touch input features

3.2.1.4.1 System shall provide foot control alternatives for ALF features.

3.2.1.4.2 System shall provide touch screen control alternatives for ALF features.

3.2.1.5 Workstation output features

3.2.1.5.1 System shall have large letter text and screen symbols.

3.2.1.5.2 System shall support minimally a 19-inch monitor for customer side.

3.2.1.6 Mobile Device output features

3.2.1.6.1 System shall mimic the standard output functioning of particular style device.

3.2.1.7 Audio output features

3.2.1.7.1 System shall provide audio response to all commands do not produce a tangible output.

3.2.1.8 Visual output features

3.2.1.8.1 System shall provide visual response to all commands that do not produce a tangible output.

3.2.2 Assisted Living Free (ALF) Features

3.2.2.1 Lights

3.2.2.1.1 System shall allow light output to be dimmable.

3.2.2.1.2 Customer shall be able to function the lights without the assistance of the system.

3.2.2.1.3 Lighting system shall be able to interface with RFID.

3.2.2.1.4 Lighting system shall be able to interface with timer controls.

3.2.2.1.5 Lighting system shall be able to interface with aural sensor control.

3.2.2.1.6 Lighting system shall be able to interface with motion sensor control.

3.2.2.2 Heating/cooling

3.2.2.2.1 System shall support standards for living.

3.2.2.2.2 Customer shall be able to function the heating and cooling through traditional interfacing.

3.2.2.2.3 Heating and cooling system shall be able to interface with timer controls.

3.2.2.2.4 Heating and cooling system shall be able to interface with aural sensor control.

3.2.2.3 Air quality

3.2.2.3.1 System shall support standards for living.

3.2.2.3.2 Customer shall be able to function the air quality through traditional interfacing.

3.2.2.4 Maintenance

3.2.2.4.1 System shall support standards for living.

3.2.2.4.2 Customer shall be able to perform maintenance through traditional interfacing.

3.2.2.4.3 Maintenance system shall be able to interface with timer controls.

3.2.2.4.4 Maintenance system shall be able to interface with aural sensor control.

3.2.2.5 Security

3.2.2.5.1 Customer shall be able to function the security system through traditional interfacing.

3.2.2.5.2 Security system shall be able to interface with RFID.

3.2.2.5.3 Security system shall be able to interface with timer controls.

3.2.2.5.4 Security system shall be able to interface with aural sensor control.

3.2.2.5.5 Security system shall be able to interface with motion sensor control.

3.2.3 Bathing features

3.2.3.1 The SHP shall provide the customer with a walk-in bath.

3.2.3.2 The SHP shall provide the customer with a cubicle shower [2].

3.2.3.3 The cubicle shower shall be equipped with an Easiflo waste pump.

3.2.3.4 The shower shall have a level access entrance.

3.2.3.5 The shower shall have an anti-slip surface.

3.2.3.6 The system shall detect moisture on the bathroom floor through a sensor.

3.2.3.7 The system shall alert the customer if the moisture remains present for more than 5 minutes after a shower is finished.

3.2.4 Dressing features

3.2.4.1 SHP shall encourage low-tech solutions such as shoehorns, dressing sticks, and zipper assistance.

3.2.5 Transferring features

3.2.5.1 The SHP shall provide the customer with stair lifts where necessary.

3.2.5.2 The stair lifts shall stop in any obstacle encountered.

3.2.5.3 The SHP shall provide the customer with the Theraposture RotoFlex Stand-Up-Bed [4].

3.2.6 Toileting features

3.2.6.1 The SHP shall provide the customer with the Washlet C100 [5].

3.2.7 Eating/cooking features

3.2.7.1 The system shall turn off power to all cooking devices in the case of fire alarm.

3.2.7.2 The system shall operate the microwave and oven through customer interfaces.

3.2.7.3 The SHP shall provide an automatic can and jar opener.

3.2.7.4 The system shall provide photo and voice guidance for cooking.

3.2.7.4.1 The system shall automatically adjust instructions based on serving size desired.

3.2.7.4.2 The system shall step through the instructions in the most basic sequence.

3.2.7.4.3 The system shall set the cooking device configuration based on the recipe.

3.2.7.5 The system shall automatically generate a shopping list based on ingredients used in cooking.

3.2.7.6 The customer shall have the ability to update the grocery list through the interface.

3.2.8 Medical features

3.2.8.1 The SHP shall provide the customer with the e-pill MD.2 Automatic Pill Dispenser [3].

3.2.8.2 The system shall alert primary caregivers when medications are not dispensed after three reminders.

3.2.8.3 The system shall interact with the Pill Dispenser by receiving information for further processing.

3.2.8.4 The system shall space alerts every 15 minutes.

3.2.8.5 The system shall alert the customer that medications need to be reloaded if 4-days worth or less of medication is remaining.

3.2.9 Communication features

3.2.9.1 The system shall integrate telephone, text messaging, and email through a unified interface.

3.2.9.2 The system shall interact with the telephone system.

3.2.9.2.1 The system shall be able to dial the telephone through customer interfaces.

3.2.9.2.2 The system shall create transcripts of all telephone conversations initiated through the system.

3.2.9.2.3 The transcripts shall be displayed in real time.

3.2.9.2.4 Transcripts shall be saved automatically.

3.2.9.2.5 The customer shall have the ability to delete transcripts.

3.2.9.2.6 The system shall automatically add incoming calls to the user directory.

3.2.9.2.7 The system shall allow telephone conversations through typing interfacing.

3.2.9.3 The system shall integrate an email client to display through the unified interface.

3.2.9.3.1 The system shall save all outgoing email messages.

3.2.9.3.2 The system shall mirror directories and actions performed on the customer's email client.

3.2.9.3.3 The system shall allow email creation through dictation.

3.2.9.4 The system shall integrate an text messaging client to display through the unified interface.

3.2.9.4.1 The system shall save all message transcripts.

3.2.9.4.2 The customer shall have the ability to delete transcripts

3.2.9.4.3 The system shall allow text message creation through dictation.

3.3 PERFORMANCE REQUIREMENTS

3.3.1 The system shall not add more than two seconds to the time required to perform an action if the system is not connected. For example, if it takes 3 seconds to turn the Microwave on normally, it will take no longer than 5 seconds for the microwave to turn on through the system.

3.3.2 System confirmation of a requested action from the user in the SHP environment shall occur in real time.

3.3.3 The logging of researcher information to the research center shall have a delay of no longer than ten seconds.

3.4 DESIGN CONSTRAINTS

3.4.1 *Customer Scalability* - For the prototype SHP, the system shall be designed to handle up to five unique RFID locators in the environment at any time.

3.5 SOFTWARE SYSTEM ATTRIBUTES

3.5.1 Reliability

3.5.1.1 *Mean Time Between Failures* – The SHP shall not fail on average more than once per week.

3.5.1.2 *Mean Time to Repair* – The SHP shall not take on average longer than two days to repair after a system failure.

3.5.2 Availability

3.5.2.1 *System Availability* - The system shall be available 95% of the time unless previously announced for scheduled maintenance or backup.

3.5.2.2 *Degraded Mode of Operations* – In the event of the unavailability of the system, the customers shall see a temporary unavailable screen or response message when requesting the system services.

3.5.2.3 *System Maintenance Notification* – In the event that the system will undergo foreknown system maintenance or data backup, users of the system shall be notified during next interaction with the system.

3.5.3 Security

3.5.3.1 *Customer Confidentiality* - The system shall not reveal any personal data in correlation to usage scenarios or statistics.

3.5.3.2 *Development Access* - All development work shall be password protected at or above the rigor of the Iowa State Computer Science password standards.

3.5.4 Maintainability

3.5.4.1 *System Reset* – The system shall provide the ability to reset all settings to the default or a saved configuration.

3.5.4.2 *Developer Access* – The system administrator shall be able to grant developer privileges to users.

3.5.4.3 *Code Maintainability* - The programming code developed for the SHP shall conform to programming style standards and shall be commented thoroughly as determined by a code review team.

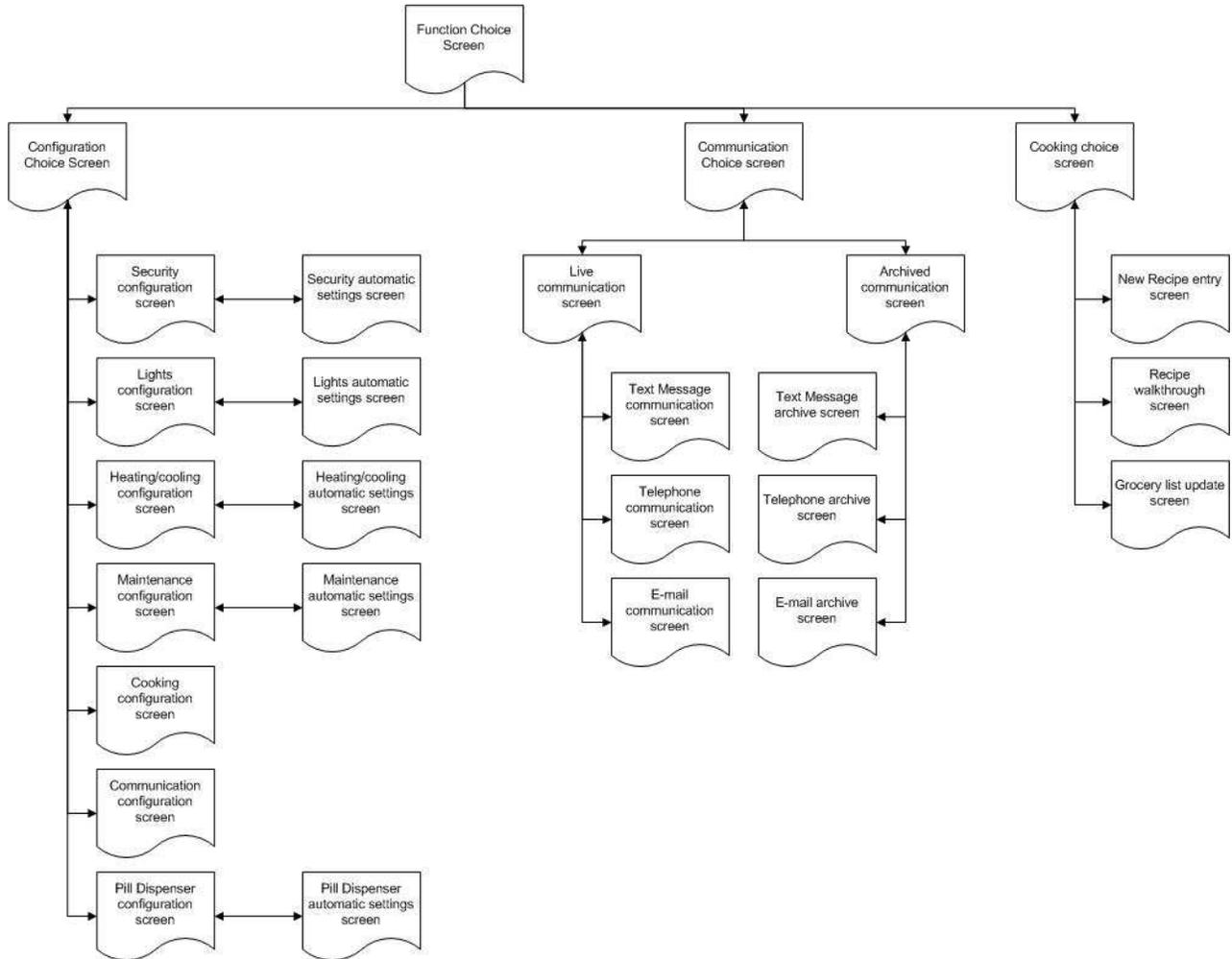
3.5.5 Portability

3.5.5.1 The system shall allow all information and applications to be run from the mobile or local infrastructure.

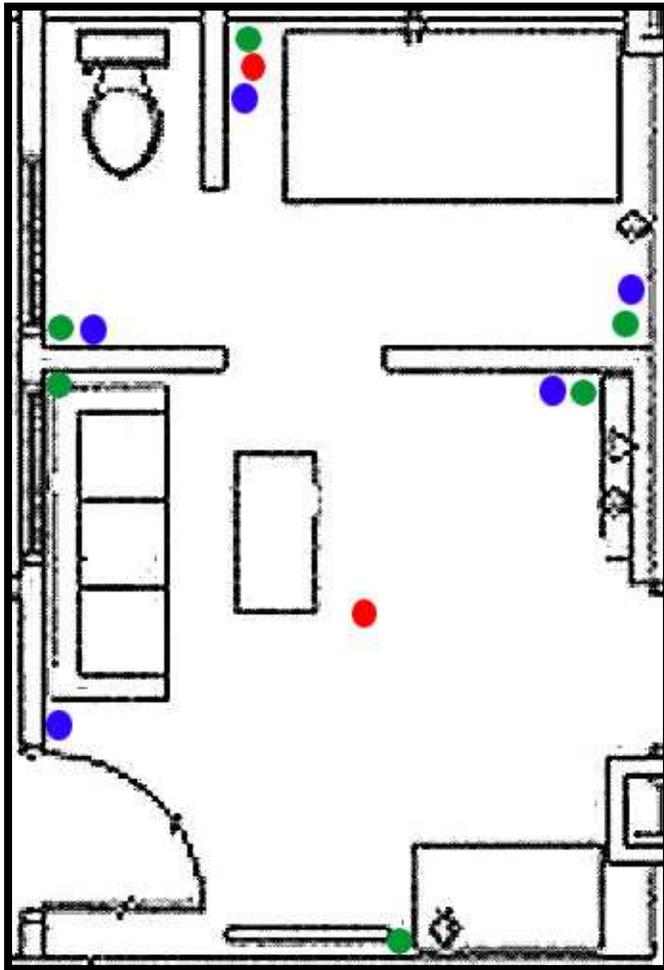
3.6 OTHER REQUIREMENTS

4 Appendix

Appendix A: Screen Flow Diagram



Appendix B: Sensor displays for SHP



Red = smoke detector

Blue = motion sensor

Green = microphone