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Chapter 1

Introduction

Introduction

Chapter 2

Functional Requirements

2.1 High-level functionality

The high level functionality of this system can be broken down into several major sections. Sensors play a major role in interfacing the real world with the several other sections of the controller. Physical security, both inside and outside of the home is important. This goes hand in hand with family security once family members have left the premises of the household. Finally, green energy management can be easily integrated with the other systems to ensure prudent usage of resources.

2.1.1 Sensors

The most crucial part of the system that ties all of the other parts together is the sensor network. They are the interface between the real world and the controllers. They detect if the house has been intruded upon by outsiders through sensors on the windows and doors. They can alert the family if somebody left the stove top on. Living patterns can be established and monitored to warn of health problems or to control the HVAC so that energy is not wasted when nobody is home or they are all asleep. Cameras, motion detectors, hall effect sensors, and other miscellaneous sensors comprise the majority of this network.

Cameras play multiple roles in the sensor network. Facial recognition can be used to detect family members entering and leaving the house to track their activities. They can be used to alert when strangers are approaching the door or are on the premises in either a friendly manner or in a more cautious one depending on the family members currently at home.

Motion detectors provide the security system with the means to trigger alerts when motion is detected in certain areas of the home while the system is armed. A network of motion detector sensors will be positioned in the hallways of the home, with particular attention to entries to the home. Motion detectors outside the house will be able to control the lighting system such that people approaching the home can be illuminated and easily identified.

Temperature sensors and hall effect sensors are two other major components. Temperature sensors can be used by both physical security, to ensure that the oven has not been on for an extended period of time without user interaction as well as for green energy management to control the overall temperature of the house or each room. Hall effect sensors can be used with temperature sensors to detect if windows or doors have been left open when they should be closed in order to prevent wasting energy. These sensors can also be used to detect intruders attempting to break in through windows or doors.

2.1.2 Family Safety

In addition to necessary home security functionality, the system will incorporate methods to provide safety to members of the users' family. Child safety is a particular concern that will be addressed by this portion of the home security system. Sensors will be implemented on cabinets as well as certain areas of the home that may contain hazardous materials that could be harmful to children. Contact sensors will be present on medicine cabinets, closets with cleaning materials, and knife drawers to alert the user that these areas of the home have been accessed.

2.1.3 Security System

2.1.4 Green Energy Management

2.2 Scenarios

2.3 Use case model

Use case name	NFCDisarmSystem
Participating Actors	Initiated by Resident
Flow of Events	<ol style="list-style-type: none">1. The Resident enters the home while in possession of an NFC device.2. The system begins the disarm countdown.3. The Resident approaches the console and holds the NFC within 0.2 meters of the console.4. The data on the NFC device is read and validated by the system.5. The system enters the disarmed state and the disarm countdown is halted.
Entry Condition	The system is in the armed state and the Resident enters the home in possession an NFC device.
Exit Condition	The system is disarmed.
Quality requirements	TODO

Use case name	KeyPadDisarmSystem
Participating Actors	Initiated by Resident
Flow of Events	<ol style="list-style-type: none"> 1. The Resident enters the home. 2. The system begins the disarm count-down. 3. The Resident approaches the console and enters their code using the keypad on the console. 4. The entered code is validated by the system. 5. The system enters the disarmed state and the disarm countdown is halted.
Entry Condition	The system is in the armed state and the Resident enters the home.
Exit Condition	The system is disarmed.
Quality requirements	TODO

Use case name	NFCArmSystem
Participating Actors	Initiated by Resident
Flow of Events	<ol style="list-style-type: none"> 1. The Resident approaches the console and holds the NFC within 0.2 meters of the console. 2. The data on the NFC device is read and validated by the system. 3. The system begins the arm countdown. 4. The Resident leaves the home. 5. The system arm countdown completes and the system enters the armed state.
Entry Condition	The system is in the disarmed state and the Resident wishes to arm it using an NFC device.
Exit Condition	The system is armed.
Quality requirements	TODO

Use case name	KeyPadArmSystem
Participating Actors	Initiated by Resident
Flow of Events	<ol style="list-style-type: none"> 1. The Resident approaches the console and enters their code. 2. The entered code is validated by the system. 3. The system begins the arm countdown. 4. The Resident leaves the home. 5. The system arm countdown completes and the system enters the armed state.
Entry Condition	The system is in the disarmed state and the Resident wishes to arm it using the keypad.
Exit Condition	The system is armed.
Quality requirements	TODO
Use case name	WindowIntrusionAlarm
Participating Actors	Initiated by any actor.
Flow of Events	<ol style="list-style-type: none"> 1. A window is opened. 2. The system receives the signal that the window has been opened. 3. The system enters the alarm state.
Entry Condition	The system is in the armed state and a window is opened.
Exit Condition	The system alarm is triggered.
Quality requirements	TODO

Use case name	DoorIntrusionAlarm
Participating Actors	Initiated by any actor.
Flow of Events	<ol style="list-style-type: none"> 1. A door is opened. 2. The system begins the alarm countdown. 3. The initiating actor does not disarm the system. 4. The alarm countdown reaches zero and the system enters the alarm state.
Entry Condition	The system is in the armed state and a door is opened.
Exit Condition	The system alarm is triggered.
Quality requirements	TODO

2.4 Object model

2.5 Dynamic model

2.6 Interfaces

Chapter 3

Non-Functional Requirements

Chapter 4

User Interfaces

The main user interface for this system is the user's smart phone device. Most individuals have a smartphone, be it an iPhone or an Android device, and integration into these platforms would make it easy for users to adopt to the system.

4.1 Smartphone Application

A smartphone application will allow the user to monitor their residence as well as turn on or off various components of the system. If the device has near-field communication built into it, then it will be able to be used to arm and disarm the system upon entry or when leaving the premises.

The application will have three main purposes. The first is to display data and statistics over time in a easily understood manner. The second is to allow fine control over various sub-systems such as the state of the security system, thermostat, and lights – both interior and exterior. The final duty is to track the status of each family member through GPS integrated into the mobile device.

It is relatively simple application. Figure 4.1 shows a wireframe of the first screen seen when the application is started. This is the main navigation between the different features. A simple settings wireframe is shown in Figure 4.2. Not all capabilities are shown in the wireframes to reduce complexity. What is displayed is dependent on the capabilities of the system and the installed modules. Navigation flow is also omitted to avoid any platform specific paradigms. Access control is required to prevent younger family members from accidentally unlocking doors or disarming the security system.

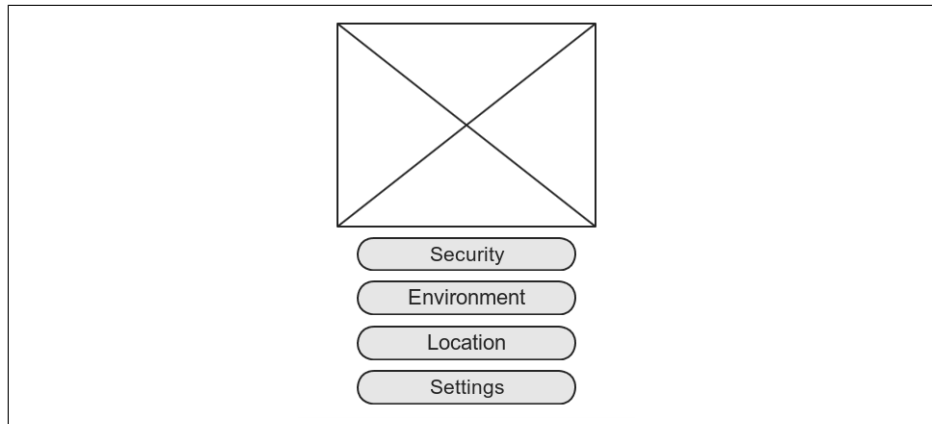


Figure 4.1: Wireframe of the home screen

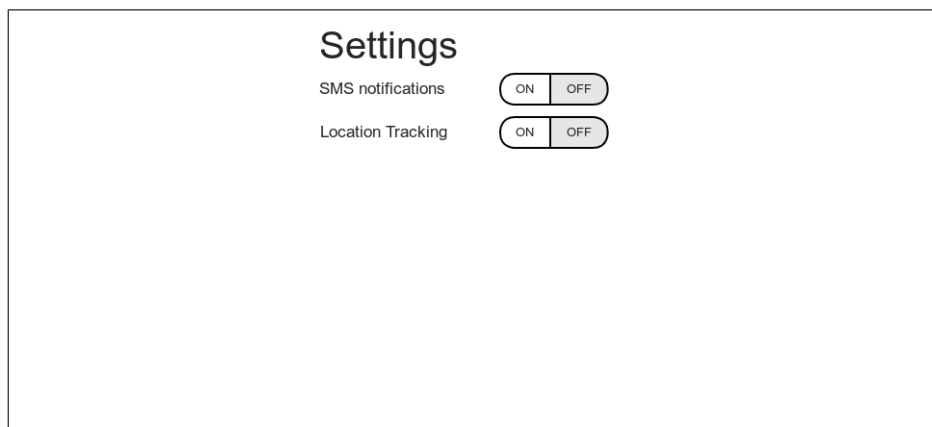


Figure 4.2: Wireframe of the settings screen

Various portions of the security system can be controlled through the wireframe in Figure 4.3. The entire system can be armed and disarmed, locks on doors activated and deactivated, and the status of the windows can be reported. Pressing on the button for window status will bring up another more detailed screen that lists individual windows and reports their status, closed or open. Door locks, if it is supported can be locked or unlocked from this screen if the lock supports it.

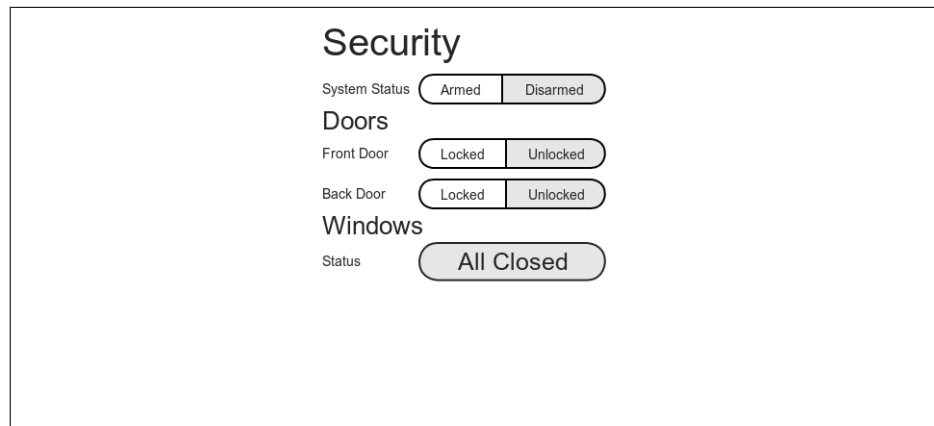


Figure 4.3: Wireframe of the security screen

Environmental details are controlled in Figure 4.4. The temperature of the house can be monitored and set. Pressing on the button labeled "HISTORY" will bring up a graph of the household temperature over a period of time. This screen can also display images from cameras at the doors to allow for the user to check who is at the door before unlocking it. Details from more specific portions of the environment can be displayed here as well. For example, the status of the stove and oven in the kitchen. It is also possible to report the internal temperature of the oven to ensure that it is not overheating.

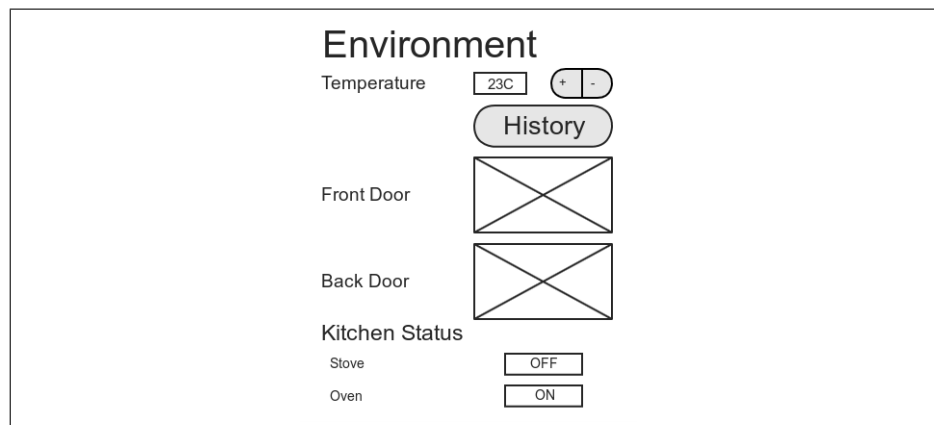


Figure 4.4: Wireframe of the environment screen

Family member locations – at least those with smartphones and this application – are displayed in Figure 4.5. Each family member will have a pin on the map to show their location using their device's GPS capabilities. Clicking on a name will move the map to the present location of that person. It will also display in text where the family member presently is located.



Figure 4.5: Wireframe of the locations screen

4.2 Near-field Communication Keypad

4.3 Web Portal