



Lancaster University College
at Beijing Jiaotong University

[Healthcare Smart Home]

CNSCC204: Software Design Coursework 1

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Healthcare Smart Homes: Requirements Document (version 2.0)

Project: Healthcare Smart Homes

Date(s): 2018.11.27

Document Status: ___ Proposed

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1. Introduction

This section will give the reader an overview of the project, including why it was conceived, what it will do when complete, and the types of people we expect will use it. We also list constraints that were faced during development and assumptions we made about how we would proceed.

1.1 Scenario Assumptions

Mary is a widow. She is 65 years old, overweight and has high blood pressure and cholesterol levels. Mary gets a new intelligent fridge. It comes with 4 temperature and 2 humidity sensors and is able to read, store, and communicate RFID information on food packages. The fridge communicates with a smart home control system in the house and integrates itself. In particular, it detects the presence of spoiled food and discovers and receives a diet plan to be monitored based on what food items Mary is consuming. An important part of Mary's diet is to ensure minimum liquid intake. The intelligent fridge monitors Mary's liquid consumption and notifies the emergency services in case the liquid intake consistently falls below a minimum threshold.

1.2 Product Perspective

There are a number of stakeholders interested in the development and smooth running of healthcare smart homes (SHS):

- Age Concern (AC) representative who represents Mary and others like her. AC must best represent Mary's desires and concerns.

- Government Health Committee (GHC) member, a government representative well versed in NHS procedures and policies whose chief role is to ensure that NHS practices are being abided by.
- System Developer (SD), who knows about smart home technologies and how much they cost etc. T's role is to suggest possible technologies and keep the team grounded in reality.
- Smart Home Builder (SHB), representing the company building the smart homes or retrofitting existing homes

2. Specific Requirements

This section of the document lists specific requirements for Healthcare Smart Home. Requirements are divided into the following sections from the perspective of stakeholders:

2.1 Age Concern (AC) Requirements

1. The Smart Home System **SHALL** monitor any aspects of the user's health as well as provide support. (FR)
 - 1.1 The fridge **SHALL** communicate with the smart home system in real time. (FR)
 - 1.2 The fridge **SHALL** communicate Radio Frequency Identification (RFID) information on food package in real time.
 - 1.3 The fridge **SHALL** detect the presence of spoiled food and discover. (FR)
 - 1.4 The fridge **SHALL** monitor and adjust the user's diet plan. (FR)
 - 1.5 The Smart Home System **SHALL** ensure the minimum liquid intake (1L/days). (FR)
 - 1.6 The Smart Home System **SHALL** be able to detect the movement of the user. (FR)
2. The Smart Home System **SHALL** be able to detect and react to the emergency of the user at once. (NFR, performance)
3. The Smart Home System **SHALL** be available for 99% of the time, that means in 24-hour period (1440 minutes), the system will be unavailable for 14.4 minutes. (NFR, reliability)
4. The Smart Home system **SHALL** continue to run under the condition of broken net and power failure. (NFR, reliability)
5. The User Interface (UI) **SHALL** be simple and provide user with as much information as possible that satisfies the old. (NFR, accessibility & usability)
6. The user **SHALL** be able to use all the system functions after one-hour training. (NFR, accessibility & usability)

7. The Smart Home System **SHALL** keep user's privacy not being accessible by the third party.
(NFR, security)
8. The Smart Home System **SHALL** have the capability to defend it from possible hacker attack.
(NFR, security)
9. The Smart Home System **SHALL** consider religion, special people (disabled people) and taboos,
which means it can provide humanistic care. (NFR, usability)
10. The electricity consumption of the Smart Home System **SHALL** be no more than 1 KWH every
day. (NFR, performance)
11. The old **SHALL** afford the cost and feed for maintenance of the Smart Home System. (NFR, cost)
12. All parts of the Smart Home System **SHALL** use environment-friendly material. (NFR, usability)
13. The Smart Home System **SHALL** be reliable as much as possible. (NFR, reliability)
 - 13.1 The mean time to failure (MTTF) of the Smart Home System **SHALL** be shorter than 1,000
hours.
 - 13.2 The mean time to repair (MTTR) of the Smart Home System **SHALL** be shorter than 24
hours.
 - 13.3 The mean time between failure (MTBF) of the Smart Home System **SHALL** be longer than
20,000 hours. (NFR, Reliability)

2.2 Government Health Committee (GHC) Requirements

- 1 The equipment **SHALL** be compliant in related sanitation (medical, European Norms Electrical
Certification (ENEC), radiation...). (FR)
- 2 The Smart Home System **SHALL** collect and store information about user's physical condition
and transmit original information to the general practitioner. (FR)
- 3 The Smart Home System **SHALL** contain the information about the nearby hospital (address of
hospital/ the availability of the number of ambulance/Number of patients in real time). (FR)
- 4 The Smart Home System **SHALL** operates under the regulation of NHS. (NFR, usability)
 - 4.1 The Smart Home System **SHALL** prevent any operations without authentication. (NFR,
usability)
 - 4.2 The Smart Home System **SHALL** cope with interface provided by NHS. (NFR, usability)

- 4.3 The Smart Home System **SHALL** obtain the authentication from the NHS when it is established. (NFR, usability)
- 5 The Smart Home System **SHALL** not interfere the emergency service by sending the false alarm to the NHS. (NFR, availability)

2.3 System Developer (SD) Requirements

- 1. The Smart Home System **SHALL** be able to react to the emergency through network transmission, or the radio to the nearby patrol. (FR).
- 2. The Smart Home system **SHALL** be able to detect the emergency through a series of judgement. (FR)
 - 2.1 The Smart Home System **SHALL** be able to detect the movement of user through infrared camera. (FR)
 - 2.2 The Smart Home system **SHALL** be able to detect the liquid consumption through sensors. (FR)
- 3. The Smart Home System **SHALL** be able to receive updating patch. (FR)
- 4. The Smart Home System **SHALL** synchronize and store the data from the user and upload to the server. (FR)
- 5. The fridge **SHALL** be able to receive the diet plan through the network. (FR)
- 6. The Smart Home System **SHALL** be able to access the network by WIFI, Bluetooth or Zigbee, Ethernet. (NFR, availability)
- 7. The Smart Home System **SHALL** apply standard API and network protocol. (NFR, availability)

2.4 Smart Home Builder (SHB) Requirements

- 1 The Smart Home System **SHALL** be able to operate under a voltage between 100v-240v. (NFR, availability)
- 2 The profit margin of building the Smart Home System **SHALL** be at least 20%. (NFR, cost)
- 3 The Smart Home System **SHALL** be compatible to the building material. (NFR, accessibility)
 - 3.1 The Smart Home System **SHALL** be electrical-grounding to prevent an electric shock. (NFR, security)
 - 3.2 The Smart Home System **SHALL** be suitable to the installation environment. (NFR, accessibility)

- 4 The fireproof endurance rating of each parts of the Smart Home System **SHALL** reach the specifications of GB50368. (NFR, security)
 - 5 The Smart Home System **SHALL** apply standard API and network protocol. (NFR, availability)
 - 6 The Smart Home System **SHALL** be able to access the network by WIFI, mobile network. (NFR, availability)
 - 7 The Smart Home System **SHALL** be easy to install, with an installation time lower than one week. (NFR, availability)
- 7.1 The Smart Home system **SHALL** be able to be directly installed at house which has already existed. (NFR, availability)

3. Requirement Conflicts

Different stakeholders may have conflicting requirements. Here are some conflicts are raised to be compared and analyzed. Some possible solutions are also proposed.

3.1 GHC & AC

Involved Stakeholders	Government Health Committee (GHC)	Age Concern (AC)
Conflicting Requirements	The Smart Home System SHALL be able to access users' personal health information to make a proper diet plan.	The Smart Home System SHALL keep users' privacy not being accessible by the third party.
Resolution	Use safe protocol and API. Inform users of their rights in the announcement.	

3.2 AC & SHB

Involved Stakeholders	Age Concern (AC)	Smart Home Builder (SHB)
Conflicting Requirements	The cost of Smart Home System SHALL be as low as possible.	The profit of building Smart Home System SHALL be as high as possible.
Resolution	Do market research to maximize of market acceptance and customer satisfactions.	

4. Glossary

Include a glossary of definitions, acronyms, and abbreviations that might be unfamiliar to some readers, especially technical terms that may not be understood by end-users or domain-specific terms that might not be familiar to developers.

[Glossary]	Definition
[API]	Application Programming Interface, a catalog of predefined functions
[Bluetooth]	Wireless technology.
[ENEC]	European Norms Electrical Certification
[MTBF]	Mean Time Between Failure
[MTTR]	Mean Time to Repair
[MTTF]	Mean Time to Failure
[NHS]	National Health Service, Medical system in UK.
[POFOD]	Probability of Failure on Demand, the probability that a demand for a service will result in system failure.
[GB50368]	The house building standard.
[GP]	General Practitioner, Doctor in UK.
[Zigbee]	Wireless communication technology.