**Concordia University Requirements evaluation and risk analysis SOEN 6481**

CS & SE Dept. Summer 2020 1/18

**SmartHome+: A Smart Home Platform**

**Task 1**

**CONSOLIDATED INSPECTION DEFECT AND INCONSISTENCY LIST**

**\*Note:** A consolidated list was prepared after going over each team member’s individual Defect and inconsistency list which are all appended as Appendix to this document.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |

**INSPECTION SUMMARY REPORT**

Project: Smart Home+

General:

Total Number of open defects\_\_\_\_\_\_\_\_\_\_\_

Total Number of open conflicts\_\_\_\_\_\_\_\_\_\_\_

Total Number of close defects\_\_\_\_\_\_\_\_\_\_\_

Total Number of close conflicts\_\_\_\_\_\_\_\_\_\_\_

Summarize number of defects by defect type and conflict type

|  |  |  |
| --- | --- | --- |
| Defect type | Number of open defects | Number of close defects |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| Conflict type | Number of open conflicts | Number of close conflicts |
|  |  |  |

Total Person-Hours expended in inspection\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task 2**

**DOCUMENTING CONFLICTS USING INTERACTION MATRIX**

An Interaction matrix (Kotonya & Sommerville, 1997) has been linked here which was prepared based on the information generated in task 1 (using features set listed within the vision document)

**Task 3**

**CONFLICT RESOLUTION**

Following is the list of identified conflicts which have further been taken into consideration for resolution.

**Conflict 1: Multiple users can trigger contradictory commands for the same room.**

* **Conflict Resolution:**

1. Provide a basic status of presently active conditions in the room to all the application users, so users can make more aware decisions regarding which command to execute at any given point of time.

* **Tactic used – Add new requirement to weaken the conflict**

1. Prepare an exhaustive list of contradictory commands which might be executed in the same room and define rules in the system to give an error to the users if they try to execute any such contradictory combination.

* **Tactic used – Add new requirement to avoid conflict**

**Conflict 2: Emergency Detection exploited for Intrusion.**

* **Conflict** **Resolution:**

1. In case of any fire/smoke related emergency system notifies the users and first tries to shut it off using home water sprinklers without immediately unlocking the point of entries automatically.

* **Tactic used – Add new requirement to weaken the conflict**

1. If an intrusion and smoke (fire) emergency is detected at the same time, use sprinklers but do not allow auto-unlocking of any point of entries, only users can unlock them.

* **Tactic used – Add new requirement to avoid conflict**

**Conflict 3: Automation of the Lightning of the room and Automated window blinds**

* **Conflict Resolution:**

1. Close the window blinds before adjusting the lightning of the system in self- evolving mode.

* **Tactic used – Restore conflicting statements i.e. the conflicting statements satisfy each other soon after the boundary condition has occurred.**

1. When the user tries to control light send and if the blinds are open popup a notification regarding the state of the blinds and expected action.

* **Tactic used - Add new requirement to weaken the conflict**

**Conflict 4: Emergency Notification & Safety measures**

* **Conflict Resolution**

1. In case of emergency, trigger alarms and send notifications to customers. If the alarm was not stopped within a predefined time duration (10 mins), then trigger an additional notification to 911 emergency services.

* **Tactic used - Add new requirement to weaken the conflict**

1. The controller will operate in two states armed (full protections) and disarmed (minimal protection). Automated calls to 911 will occur only during armed state

* **Tactic used - Avoid boundary condition**

**Conflict 5: XXXXXX**

* **Conflict Resolution**

1. XXXXX.

* **Tactic used – XXXX**

**Conflict 6: XXXXXX**

* **Conflict Resolution**

1. XXXXX.

* **Tactic used - XXXX**

**Conflict 7: XXXXXX**

* **Conflict Resolution**

1. XXXXX.

* **Tactic used – XXXX**

**Conflict 8: XXXXXX**

* **Conflict Resolution**

1. XXXXX.

* **Tactic used – XXXX**

**Task 4**

**CONFLICT EVALUATION**

Using **weighted matrices** the above mentioned conflict resolution suggestions have been evaluated.



**Conflict 1: Multiple users can trigger contradictory commands for the same room.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evaluation criteria Non-Functional Requirement (NFR)** | **Significance weighting** | **Give user the present status and let them decide** | **Prepare set of contradictory rules and implement** |
| Cost | 0.7 | .7 | .3 |
| Usability | 0.3 | .6 | .4 |
| **Total** | **1.0** | **.59** | **.33** |

**Option1 -** **Give user the present status and let them decide** contributes more in terms of improving the Non-Function Requirements so is a better alternative.

**Conflict 2: Emergency Detection exploited for Intrusion.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evaluation criteria NFR** | **Significance weighting** | **Try to tackle fire using sprinklers before auto unlocking point of entries.** | **Use sprinklers but only allow manual unlocking if intrusion and smoke (fire) emergency occur together.** |
| Security | 0.5 | .3 | .6 |
| Safety | 0.5 | .4 | .7 |
| **Total** | **1.0** | **.35** | **.65** |

**Option2 -** **Use sprinklers but only allow manual unlocking if intrusion and smoke (fire) emergency occur together** contributes more in terms of improving the Non-Function Requirements so is a better alternative.

**Conflict 3: Automation of the Lightning of the room and Automated window blinds.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evaluation criteria NFR** | **Significance weighting** | **Close Blinds** | **Send notifications** |
| Reliable outcome | 0.7 |  |  |
| Usability | 0.3 |  |  |
| **Total** | **1.0** |  |  |

**OptionXXX -** **XXXX** contributes more in terms of improving the Non-Function Requirements so is a better alternative.

**Conflict 4: Emergency Notification & Safety measures.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evaluation criteria NFR** | **Significance weighting** | **Armed State** | **Time given to cancel alarms** |
| Reliability | 0.5 |  |  |
| Usability | 0.3 |  |  |
| Minimal inconvenience | 0.2 |  |  |
| **Total** | **1.0** |  |  |

**OptionXXX -** **XXXX** contributes more in terms of improving the Non-Function Requirements so is a better alternative.

**Task 5**

**RISK MANAGEMENT**

**1. Identified Risk:** Unauthorized access to any of the installed devices using default password used for connectivity. (Non-Functional Requirement: Security)

**Risk Type**: Product Related Risk

**Risk Likelihood** - Low. The attacker needs to possess sufficient technical skill/knowledge to exploit this security loophole.

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Loss of security | Catastrophic | Catastrophic | Severe |
| Loss of privacy | Sever | Severe | High |
| Gain access to other devices in network | High | High | Low |
| Use the devices as bots for security attacks | Low | Low | Low |

Rationale:

1. Loss of privacy and security defeats the whole vision of the product and it can result in catastrophic outcomes like break in, burglary, violence etc.
2. Gain access to other devices in the network - A hacker can gain access to other devices in the network and use it inappropriately. Though it’s not catastrophic it will have a high impact on user experience of the system.
3. Use the devices as bots for security attacks - Users may not have any impact on user experience or the impact can be low like high bandwidth usage. In some cases, users may not even be aware of the impact.

**Counter Measure 1:** Controller resets the default password of the smart device with a uniquely generated password as soon as the device is successfully paired with the controller.

**Tactic used: Avoid risk**

**Counter Measure 2:** Display warnings to the user via the mobile app, local monitor or the voice-based assistants that the smart device has the default password and the user needs to reset it. User is given the option to fix it or snooze the warning.

**Tactic used: Reduce risk likelihood**

**2. Identified Risk:** Loss of camera footages or usage pattern data when storage is full (applies to both local and cloud storage) NFR: Performance

**Risk Type**: Product Related Risk

**Risk Likelihood** - Moderate. 1. Users will not be able to view the latest surveillance footage. 2. Improper functioning of the devices in self-evolving mode as it depends on the usage pattern data.

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Loss of footages | Severe | High | High |
| Loss of surveillance | Severe | Severe | High |
| Improper function of devices based on outdated usage data | Severe | High | Moderate |
| Low performance of controller in case of retries to store/upload data | Low | Low | Low |

Rationale:

1. Loss of surveillance and footage are deemed severe since the customer will lose the sense of safety and security of the home.
2. If the device evolves on outdated usage data, the actual output can severely affect the user experience.
3. In some cases, multiple retries by the controller to store/update data can affect performance.

**Counter Measure 1:** Clear the storage when it reaches a specified threshold in the order of earliest data first until the available storage comes below the threshold.

**Tactic used: Avoid risk**

**Counter Measure 2:** Display warning to the user that storage is full, and they need to clear it or it will result in loss of data.

**Tactic used: Reduce risk likelihood**

**Counter Measure 3:** Before applying modifications to the device based on the usage pattern in self-evolving mode check if the data used include the latest hour data.

**Tactic used: Reduce risk consequence likelihood.**

**3. Identified Risk:** Frequently unstable connectivity which messed up all the internet-based services in this product because this product heavily depends on the Internet. NFR: Reliability

**Risk Type**: product Related Risk

**Risk Likelihood** - High.

1. All the services related to the internet based would be stopped, even need to restart some services for reconnection if the services have defect itself.

2. Without reliable, secure and spontaneous internet connection (i.e., 24/7 hours), would affect the services of the product.

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Loss on connectivity | Catastrophic | High | High |
| Impact on messaging/notification on proper time | Severe | Severe | High |
| Impact on intrusion detection | Severe | moderate | moderate |
| Loss of recorded data | moderate | High | High |

Rationale:

1. Loss of connectivity leads to stopping all the services which are dependent on the internet from the proposed features.
2. It would have an impact on the messaging and sending notification on a proper time, even failing to trigger a fire alarm because of dropping internet services. In addition, it has an impact on intrusion detection.
3. Due to internet connection recorded data may be lost either on cloud or local machine.

**CounterMeasure-1:** ISP should provide 24/7 internet connection anyhow with proper bandwidth (i.e., high Speed internet). /**/ automatically switch over to a different mode of connectivity (4G, 5G…..)**

**Tactic used : Avoid risk**

**CounterMeasure-2:** Make sure all the services are capable of reconnecting automatically with restarting the embedded device after regaining access to the internet.

**Tactic used : Reduce risk likelihood**

countermeasure-3: automatic retry after reconnect to upload recorded data………...

**4. Identified Risk:** Automatic window control may impact if there is any obstacle on path or resistance entercount on the way. NFR: Safety

**Risk Type**: Product Related Risk

**Risk Likelihood** - Moderate.

1. While opening or closing the window according to the command there would be some risk if any obstacle present there.

2.The obstacle may be broken down due to the automatic window blinds .

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Things may break near window | Moderate | High | High |
| Impact on windows movement | Severe | Severe | High |
| Loss on budget for repairing window | Severe | moderate | moderate |
| affect of life like kids |  |  |  |

Rationale:

1. During **automatic blinds of the wi**ndows things may break if somethings present on the window path.
2. When the clash happened between window and obstacle (i.e., objects on the path of the window), natural operating mode of the window may impact which leads to repair of the windows.
3. For repairing the window, users  need to spend some money from their savings.

**CounterMeasure-1:** While opening and closing the window, windows should reverse back if any obstacle is found on the path of movement.

**Tactic used : Avoid risk**

**CounterMeasure-2:** Make sure the window pathway is free for opening and closing the window before starting the command of opening and closing the window.

**Tactic used : Reduce risk likelihood**

**5. Identified Risk:** Automated pet feeding station can raise animal safety concern, food can be polluted by  external force like wind, rain, dirt, inedible particle  etc

**Risk Type**: Product Related Risk

**Risk Likelihood** - High

* Environmental impact like rain, dust, dirt, heat can pollute food
* Animal can be overfeed themselves
* Animal can be exposed to danger if they try to play with the automated feeding station

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Polluted food | Severe | Severe | Severe |
| over eating | High | Moderate | Moderate |
| Accidents from playing with food station | Severe | Severe | Severe |

Rationale:

1. Polluted food can raise serious concern regarding animal health
2. Over eating on a regular basis can be harmful for animal
3. Playing with food station equipment could cause serious accident

**CounterMeasure-1:** Provide the owner option to limit food disposal to avoid overeating.

**Tactic used : Avoid risk**

**CounterMeasure-2:** Notify user daily to inspect feeding station for its cleanliness, set the station indoor

**Tactic used : Avoid Risk**

**CounterMeasure-3:** Increase disposal unit security by using soft build material like plastics and foam, adding sensors to avoid unit movement if the animal is riding on the disposal unit

**Tactic used : Reduce risk likelihood**

**5. Identified Risk:** System will become obsolete when there is a power failure and the back up battery runs out**.**

**Risk Likelihood:** Moderate

1. All the system will shut down making the house vulnerable to any types of attack( like fire, flood , theft or intrusion ), manual handling of devices and less.
2. All the Automation would stop and all the Mundane activities are to be performed by the user.

**Qualitative assessment:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Consequences** | **Likely** | **Possible** | **Unlikely** |
| Loss of Security | Severe | High | High |
| Loss of Safety | Severe | Severe | High |
| Manual Handling of devices | High | Moderate | Low |
| Loss of Automation | Moderate | Moderate | Low |

Counter measure 1:

Make sure that only the most necessary services are consuming the battery, when there is a power failure. This can help to extend the usage of the battery. The system can also notify the users regarding the battery levels(Reduce Risk Likelihood)

Counter measure 2:

Fuel based battery can be used. The system can notify the user to refuel the battery before it runs out (Avoid Risk).

Counter Measure 3:

Electricity board should provide proper electricity with power cuts not more than 24 hours. ( Avoid Risk).

**APPENDIX:**

**INDIVIDUAL DEFECT AND INCONSISTENCY LISTS**

**Project: Smart Home+**

**Inspector: Apoorv Semwal Time spent by Inspector: 60mins**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1 | Section - 4.1 -Product Perspective – Usage of term IOT. | Forward Reference - No prior explanation /reference to it. | Minor | Apoorv | Open | 13-Jul-2020 |
| 2 | Section - 4.3 -Needs and Features – Security Measures - Home Alarms. | Unintelligibility - Stating just a device name is not enough to define it as a feature and its purpose. | Minor | Nikhil | Open | 13-Jul-2020 |
| 3 | Missing feature for Window access control | Omission – No specific feature mentions anything about an automated Window access control | Major | Nikhil | Open | 13-Jul-2020 |
| 4 | Section - 4.3 - Needs and Features – Multi User Mode of Operation and Household Automation. | Strong Conflict – Multiple users can trigger contradictory commands for the same room. Say switch on the AC and Open Window | Major | Apoorv | Open | 13-Jul-2020 |
| 5 | Needs and Features - Security Measures – Exploiting Emergency Detection for doing an Intrusion. | Strong Conflict – An intruder might try to create an emergency like situation say a small fire to trigger Emergency Detection system to open all doors and windows. | Major | Apoorv | Open | 13-Jul-2020 |

**Inspector: Divya Bhagavathiappan Shiva Time spent by Inspector: 60mins**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1 | Assumptions:  Controller and the smart devices both provide support for connectivity using Wi-Fi/Bluetooth | Poor Structuring  Assumption does not differentiate local and remote connectivity | Minor | Divya | Open |  |
| 2 | Security Measures:  Home Alarm and Intrusion detection | Overlapping - Home Alarm is triggered when intrusion is detected | Minor |  | Open |  |
| 3 | Emergency Detection | Incomplete - Does not provide insight on how to notify emergencies | Major |  | open |  |
| 4 | Automation of the Lightning of the room and Automated window blinds | Strong Conflict - Lighting in a room can be affected by natural light | Minor |  | open |  |
| 5 | Emergency notification | Omission - Emergency notifications should also be displayed in local monitors and through voice based assistants | Major |  | open |  |
| 6 | Storage | Overlapping - Local and cloud storage | Minor |  | open |  |
| 7 | Routine Activities | Overlapping - Kitchen and medicine inventory management | Minor |  | open |  |
| 8 | Emergency Notification & Safety measures | Weak Conflict - Automated calls should not happen if the customer takes responsibility for the emergency notification event. | Minor |  | open |  |

**Inspector: Sakib Shuvo Time spent by Inspector: 60mins**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1 | Section: 3.2 User environment; Page 4  Self-evolving Mode | Forward Reference:  Definition of self evolving mode was given later in Appendix | Minor | sakib | open |  |
| 2 | Section 4.4: Alternative and Competition:  Bell canada Description | Unintelligibility | minor | sakib | open |  |
| 3 | Section 4.3: Needs and Feature  Mode of Operation  for user vs device to work | Terminology clash | major | sakib | open |  |
| 4 | Section 4.2 Dependency  last point in dependency is not clear | opacity | major | sakib | open |  |
| 5 | Section 4.4  Needs and Feature  Mode of access control, remote vs local | Poor Structuring:  both home and remote control are internet based | major | sakib | open |  |

**Inspector: Manik Hossain Time spent by Inspector: 80mins**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1. | Need & Features :  Automated call to 911 and fire department | **Overspecification** : Sometime fire alarm rings for a while but it can be easily control at home instead of disturbing these department | Major | Manik Hossain | Open |  |
| 2. | Need & Features:  Routine Activities like kitchen, medicine inventory management and automated feeding plan for pets. | **Opacity**: in this vision document there is no rationale, authoring or dependencies (these are invisible) for this need and features. | Minor |  | Open |  |
| 3 | Need & Features: Smart irrigation and automated gardening, swimming pool maintenance | **Noise**: There is no specification of any real world problem on these topics. | Major |  | Open |  |
| 4 | Features and Need:  Safety Measures | **Terminology / Designation Clash**: 911 and fire control department are same but used in different ways. | Minor |  | Open |  |
| 5 | Needs & Features: Automated feeding plan for pets | **Unfeasibility**: it seems unrealistic because it cannot be implemented in terms of developer perspective. | Minor |  | Open |  |

**Inspector: Nikhil Nikhil Time spent by Inspector: 120mins**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Defect # | Location | Defect/inconsistency type | Classification | Author | Status | Date corrected |
| 1 | Features for specially-abled members of the family. | Omission | Minor |  | Open |  |
| 2 | 4.3 Needs and features:  Self-evolving mode | Forward reference | Minor |  | Open |  |
| 3 | 5.2 and 5.3 Platform requirements:  Mentions about Java and Linux which are more technical terms. | Unintelligibility | Major |  | Open |  |
| 4 | 2.2: Product Position Who: talks only about managing devices and automation of tasks.  Should mention security and other stuff. | inadequacy | minor |  | open |  |
| 6 | Consideration for privacy of the users | omission | major |  | open |  |
| 7 | User environment:  It should detail the current working environment of the user. Instead the document focuses on how user can access the smarthome+ system. | Poor structuring | major |  | open |  |
| 8 | Usage pattern Analyzer | infeasible | minor |  | open |  |
| 9 | Needs and Feature:  Automated Rain harvesting ,  Alternative energy harnessing system,  Is the same | Terminology inconsistency | major |  | open |  |