

**CS550 Software Engineering**

**SafeHome Project**

**Second Report (Design Model)**

|  |  |
| --- | --- |
| **20073580** | **Dong-Hyun Choi** |
| **20064076** | **Dong-Yun Yang** |
| **20073284** | **Ji-Yong Shin** |
| **20074045** | **Pham Minh Duc** |
| **20075230** | **Suraj Pandey** |



**Project Team #3 Members:**

[I. Overview 6](#_Toc167632652)

[1. Introduction 6](#_Toc167632653)

[2. Goal 6](#_Toc167632654)

[3. How the design work proceeded 6](#_Toc167632655)

[4. Assumptions 7](#_Toc167632656)

[II. Architectural structure 8](#_Toc167632657)

[1. Overall Architecture 8](#_Toc167632658)

[2. External Communication Management 9](#_Toc167632659)

[3. Surveillance 10](#_Toc167632660)

[4. Security 11](#_Toc167632661)

[5. Configuration and Data Management 12](#_Toc167632662)

[III. Class Diagram 13](#_Toc167632663)

[1. Class Diagram – whole system overview 13](#_Toc167632664)

[2. Class Diagram – Backbone 14](#_Toc167632665)

[3. Class Diagram – around configuration manager 15](#_Toc167632666)

[4. Class Diagram – around system (Device related) 16](#_Toc167632667)

[5. Class Diagram – around web interface 17](#_Toc167632668)

[6. Class Diagram – page hierarchy 18](#_Toc167632669)

[IV. CRC cards 19](#_Toc167632670)

[1. Around ConfigurationManager 19](#_Toc167632671)

[2. Around System (Device related) 22](#_Toc167632672)

[3. Around WebInterface 25](#_Toc167632673)

[V. State Diagram 26](#_Toc167632674)

[1. Classes around ConfigurationManager 26](#_Toc167632675)

[a. State Diagram for ConfigurationManager 26](#_Toc167632676)

[b. State Diagram for Log 27](#_Toc167632677)

[c. State Diagram for LogManager 28](#_Toc167632678)

[d. State Diagram for LoginInterface 29](#_Toc167632679)

[e. State Diagram for LoginManager 30](#_Toc167632680)

[f. State Diagram for SafetyZone 31](#_Toc167632681)

[g. State Diagram for SafeHomeMode 32](#_Toc167632682)

[h. State Diagram for StorageManager 33](#_Toc167632683)

[i. State Diagram for SystemSettings 34](#_Toc167632684)

[2. Classes around System (Device related) 35](#_Toc167632685)

[a. State Diagram for Alarm 35](#_Toc167632686)

[b. State Diagram for CameraController 36](#_Toc167632687)

[c. State Diagram for MotionSensor 37](#_Toc167632688)

[d. State Diagram for SafeHomeCamera 38](#_Toc167632689)

[e. State Diagram for Sensor 39](#_Toc167632690)

[f. State Diagram for SensorController 40](#_Toc167632691)

[g. State Diagram for System 41](#_Toc167632692)

[h. State Diagram for WindowDoorSensor 42](#_Toc167632693)

[3. Classes around WebInterface 43](#_Toc167632694)

[a. State Diagram for DeviceIcon 43](#_Toc167632695)

[b. State Diagram for FloorPlan 44](#_Toc167632696)

[c. State Diagram for Page 45](#_Toc167632697)

[d. State Diagram for WebInterface 46](#_Toc167632698)

[VI. Sequence Diagram 47](#_Toc167632699)

[1. Common Sequence Diagram 47](#_Toc167632700)

[a. Log onto the system through control panel 47](#_Toc167632701)

[b. Log onto the system through web browser 48](#_Toc167632702)

[c. Configure system setting 49](#_Toc167632703)

[d. Turn the system on 50](#_Toc167632704)

[e. Turn the system off 52](#_Toc167632705)

[f. Reset the system 53](#_Toc167632706)

[g. Change master password through control panel 54](#_Toc167632707)

[2. Security Sequence Diagram 55](#_Toc167632708)

[a. Arm/disarm system through control panel 55](#_Toc167632709)

[b. Arm/disarm system through web browser 56](#_Toc167632710)

[c. Arm/disarm safety zone selectively 57](#_Toc167632711)

[d. Alarm condition encountered 58](#_Toc167632712)

[e. Configure safety zone 59](#_Toc167632713)

[f. Create new safety zone 60](#_Toc167632714)

[g. Delete safety zone 61](#_Toc167632715)

[h. Update an exist safety zone 62](#_Toc167632716)

[i. Configure SafeHome modes 63](#_Toc167632717)

[j. View intrusion log 64](#_Toc167632718)

[k. Call monitoring service through control panel 65](#_Toc167632719)

[3. Surveillance Sequence Diagram 66](#_Toc167632720)

[a. Display Specific camera view 66](#_Toc167632721)

[b. Pan/Zoom specific camera view 67](#_Toc167632722)

[c. Set camera password 68](#_Toc167632723)

[d. Delete camera password 69](#_Toc167632724)

[e. View thumbnail Shots 71](#_Toc167632725)

[f. Enable camera 72](#_Toc167632726)

[g. Disable camera 73](#_Toc167632727)

[VII. Design evaluation 74](#_Toc167632728)

[1. Architectural Design Metric 74](#_Toc167632729)

[a. Design Structure Quality Index (DSQI) 74](#_Toc167632730)

[b. Fenton's simple morphology metrics 74](#_Toc167632731)

[2. CK Metrics 75](#_Toc167632732)

[3. MOOD Metric 76](#_Toc167632733)

[a. MIF (Method Inheritance Factor) 76](#_Toc167632734)

[b. CF (Coupling Factor) 77](#_Toc167632735)

[4. OO Metric Proposed by Lorenz and Kidd 78](#_Toc167632736)

[5. General Evaluation of Goal 79](#_Toc167632737)

[VIII. Lessons Learned 80](#_Toc167632738)

[IX. Who did What 81](#_Toc167632739)

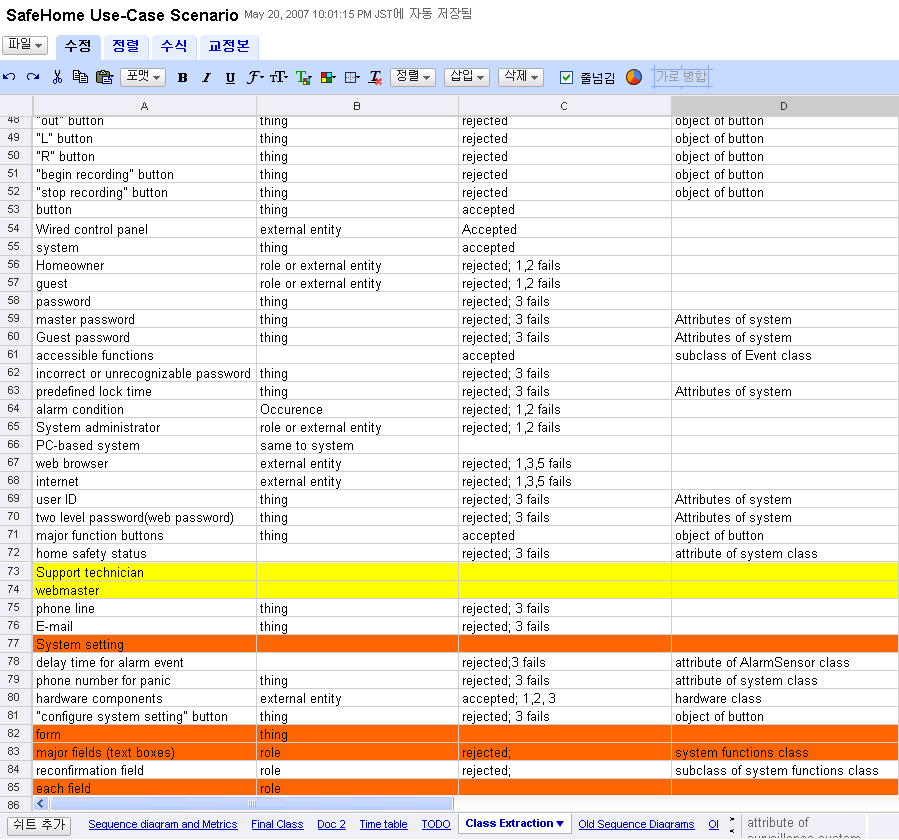
\*By CTRL+Click, you can move to the desired page in the table of contents.

I. Overview

1. Introduction

This document describes the design model of SafeHome system proposed in the previous report. Since the design phase of the product is directly connected to the implementation phase, we focus on the well-formed and concrete design of the system. Architectural structure, class diagram, CRC cards, state diagrams, and sequence diagrams are presented to portray the design of the system.

1. Goal
2. Completely follow the requirement and the analysis model.
3. Achieve low coupling, high cohesion, and modularity.
4. Pursue testability, integrity, efficiency, maintainability, and reliability.
5. Minimize complexity and consider reusability and flexibility.
6. How the design work proceeded
7. Extraction of classes: To achieve correctness of the design model we used the method in chapter 8.7 of SEPA. We reviewed nouns and verbs from use case scenarios to extract classes.



1. Creation of architectural structure: Based on the classes extracted and the use case scenario, we created the architectural structure of the SafeHome system.
2. Creation of class diagram: On the basis of extracted classes and architectural structure, we created the class diagram considering the implementation.
3. Creation of CRC card.
4. Refinement of class diagram: By testing the design using CRC card and reviewing the requirement document and the first report, we refined the class diagram. In addition we focused on ways to achieve low coupling and high cohesion. Actual implementation plan became more concrete and added some classes from java and for database access
5. Creation of state diagram.
6. Refinement of class diagram: Added some missing functions and attributes
7. Creation of sequence diagram: Based on the use case scenario we created the sequence diagram. It enabled us to check if the design followed the requirement specification and the first report.
8. Review of state and sequence diagram: Tested based on the first report.
9. Refinement of class diagram: Added some missing functions and attributes in the view point of implementation.
10. Assumptions
11. The details about the Java classes from the library and classes given by TA are not described in this document.
12. Although the web interface should be loaded on the web browser to communicate with the system through network connection, we follow the professor’s advice that the web interface can be implemented as applet in the same program with the system.

II. Architectural structure

1. Overall Architecture



1. External Communication Management



1. Surveillance



1. Security



1. Configuration and Data Management



III. Class Diagram

1. Class Diagram – whole system overview



1. Class Diagram – Backbone



1. Class Diagram – around configuration manager



1. Class Diagram – around system (Device related)



1. Class Diagram – around web interface



1. Class Diagram – page hierarchy



IV. CRC cards

1. Around ConfigurationManager

|  |  |
| --- | --- |
| **Class: ConfigurationManager** | |
| Manage the access to configuration of the SafeHome system which includes System settings, Safety Zone information, SafeHome mode information and so on. | |
| **Responsibilities** | **Collaborators** |
| Initialize the configuration information |  |
| Updates system settings | SystemSettings |
| Updates SafeHome modes | SafeHomeMode |
| Modifies safety zone information | SafetyZone |
| Gives system setting information | SystemSetting |
| Gives current SafeHome mode | SafeHomeMode |
| Gives Safety Zone information | SafetyZone |

|  |  |
| --- | --- |
| **Class: Log** | |
| Add/Retrieve event information as separate log instance | |
| **Responsibilities** | **Collaborators** |
| Read/write date time of the event |  |
| Read/write description of the event |  |
| Read/write event log id for each event |  |

|  |  |
| --- | --- |
| **Class: LogManager** | |
| Manages each log instance information | |
| **Responsibilities** | **Collaborators** |
| Save log instance | StorageManager |
| Get list of log events from storage |  |

|  |  |
| --- | --- |
| **Class: LoginInterface** | |
| Manages login information for all the users. Users are classified according to the login interface. Hence each interface has its own username, passwords, and level of access. | |
| **Responsibilities** | **Collaborators** |
| Read/write username |  |
| Read/write password |  |
| Read/write user’s interface |  |
| Read/write user’s level of access |  |
| Read/write password properties |  |
| Read/write number of tries |  |
| Read/write serializable properties |  |
| Save login information | StorageManager |
| **Class: LoginManager** | |
| Manages logging process and changing of passwords using each instance of ‘LoginInterface’ class. | |
| **Responsibilities** | **Collaborators** |
| Manage log in | LoginInterface |
| Manage log out | LoginInterface |
| Manage changing passwords | LoginInterface, StorageManager |

|  |  |
| --- | --- |
| **Class: SafetyZone** | |
| Manages the information for each SafetyZone such as the SafetyZone ID, name, sensors list of SafetyZone, the armed status of SafetyZone. | |
| **Responsibilities** | **Collaborators** |
| Identify the armed status of SafetyZone |  |
| Identify SafetyZone name |  |
| Defines SafetyZone name |  |
| Identify SafetyZone ID |  |
| Defines SafetyZone ID |  |
| Identifies the sensors list of a SafetyZone |  |
| Defines sensors list for a SafetyZone |  |
| Remove all sensors from a SafetyZone |  |
| Store SafetyZone’s information |  |

|  |  |
| --- | --- |
| **Class: SafeHomeMode** | |
| Manages the sensor list for each SafeHome Mode such as Home, Away, Overnight travel, Extended Travel. | |
| **Responsibilities** | **Collaborators** |
| Identify mode name |  |
| Identifies the SafeHomeMode ID |  |
| Defines SafeHomeMode ID |  |
| Identifies the sensors list of a SafeHome mode |  |
| Defines sensors list for a SafeHome mode |  |
| Add a new sensor to a SafeHome mode |  |
| Remove a sensor from a SafeHome mode |  |
| Store SafeHome mode information |  |

|  |  |
| --- | --- |
| **Class: StorageManager** | |
| Manage information in a database via JDBC. This class is a linkage for translation of queries from other classes into SQL language. It also manages connection, query processing and retrieval of result set from the database. | |
| **Responsibilities** | **Collaborators** |
| Store username/password for logging in to the database | DB\* |
| Store database connection object |  |
| Create query statements |  |
| Executes database related queries from other classes | DB\* |
| Manage connect/disconnect to database | DB\* |

Note:

\* Database is independent of classes. For our project we will be using MySQL database.

|  |  |
| --- | --- |
| **Class: SystemSettings** | |
| Reads, maintains and writes phone number of monitoring service, phone number of homeowner, system lock time, and delay time before alarming. | |
| **Responsibility** | **Collaborator** |
| Maintains system lock time |  |
| Maintains phone number of monitoring service |  |
| Maintains phone number of homeowner |  |
| Maintains delay time before alarming |  |
| Reads the data corresponding to the attributes from the database | StorageManager |
| Writes the data corresponding to the attributes to the database | StorageManager |

1. Around System (Device related)

|  |  |
| --- | --- |
| **Class: Alarm** | |
| Alarm class connects the system and alarm hardware device. In other words, it is the device driver of alarm hardware. | |
| **Responsibilities** | **Collaborators** |
| Gives alarm(hardware) information |  |
| Ring the alarm |  |
| Check whether the alarm rings |  |

|  |  |
| --- | --- |
| **Class: CameraController** | |
| Controller class that creates, deletes, and manages a list of SafeHomeCamera objects So, it control the cameras’ operation by “enable/disable”, “zoom/pan” through SafeHomeCamera objects. | |
| **Responsibilities** | **Collaborators** |
| Add a camera at the specified position | SafeHomeCamera |
| Delete a camera that has a specific id | SafeHomeCamera |
| Enable specific cameras to work | SafeHomeCamera |
| Disable specific cameras | SafeHomeCamera |
| Enable all cameras to work | SafeHomeCamera |
| Disable all cameras | SafeHomeCamera |
| Enable a specific camera to work | SafeHomeCamera |
| Disable a specific camera | SafeHomeCamera |
| Zoom/Pan a specific camera | SafeHomeCamera |
| Display a thumbnail view | SafeHomeCamera |
| Display a single view | SafeHomeCamera |

|  |  |
| --- | --- |
| **Class: MotionSensor** | |
| **Super: Sensor** | |
| Wrapper class of the virtual hardware component class “MotionDetector” that connects the system and motion sensor hardware. In other words, it is the device driver for motion sensor. | |
| **Responsibilities** | **Collaborators** |
| Arms a sensor | MotionSensor (Given by TA) |
| Disarms a sensor | MotionSensor (Given by TA) |
| Reads a sensor signal | MotionSensor (Given by TA) |
| Gives sensor location | MotionSensor (Given by TA) |

|  |  |
| --- | --- |
| **Class: SafeHomeCamera** | |
| Manage state information of a given camera and control the operation of that camera. | |
| **Responsibilities** | **Collaborators** |
| Manage a camera state information(id, location, pan angle, zoom degree, password, working state) |  |
| Display a view | Camera |
| Zoom in | Camera |
| Zoom out | Camera |
| Pan left | Camera |
| Pan right | Camera |
| Get/Set password |  |
| Enable/Disable a camera | Camera |

|  |  |
| --- | --- |
| **Class: Sensor** | |
| Contains the information of a sensor such as sensor ID, sensor type, sensor location, sensor status, and detect signal for sensor. | |
| **Responsibility** | **Collaborator** |
| Identify the status of sensor |  |
| Identifies the sensor ID |  |
| Defines the sensor ID |  |
| Identifies the sensor type |  |
| Defines the sensor type |  |
| Identifies the sensor location |  |
| Defines the sensor location |  |
| Activate/Deactivate the sensor |  |

|  |  |
| --- | --- |
| **Class: SensorController** | |
| Controller class of the sensors which contains management functions for sensors such as Add a sensor, delete a sensor, and so on. It allows arm or disarm sensors of SafeHome product. | |
| **Responsibility** | **Collaborator** |
| Add a new sensor | Sensor |
| Remove a sensor | Sensor |
| Activate a sensor or a list of sensors | Sensor |
| Deactivate a sensor or a list of sensors | Sensor |
| Retrieval sensors’ information | Sensor |

|  |  |
| --- | --- |
| **Class: System** | |
| The main body of the program. Give command to and monitors all the devices, receives input command from web interface and control panel, respond to command, and so on | |
| **Responsibility** | **Collaborator** |
| Receive user input or command from user interface | WebInterface, ControlPanel |
| According to the user input or command, system sends request to each components and get response | LoginManager, LogManager, ConfigurationManager, SensorController, CameraController, Alarm |
| Read Sensors by polling | SensorController |
| Send message | WebInterface, ControlPanel |
| Call monitoring service |  |
| Turn on the system |  |
| Turn off the system |  |
| Reset the system |  |
| Lock system for defined time | ConfigurationManager |

|  |  |
| --- | --- |
| **Class: WindowDoorSensor** | |
| **Superclass: Sensor** | |
| Connect to window/door sensor hardware (WinDoorSensor class provided by the TA). Read sensor status and controls sensor. | |
| **Responsibility** | **Collaborator** |
| Chech if sensor is ready to be armed | WinDoorSensor |
| Connect to window/door sensor hardware | WinDoorSensor |

1. Around WebInterface

|  |  |
| --- | --- |
| **Class: DeviceIcon** | |
| Represents devices such as sensors, alarm, and camera on the floor plan. | |
| **Responsibility** | **Collaborator** |
| Hold image data of a device |  |
| Gives image data on request | Page |
| Holds location and size information of itself |  |

|  |  |
| --- | --- |
| **Class: FloorPlan** | |
| Contains given image provided by the TA which is describes the blue print of the house. | |
| **Responsibility** | **Collaborator** |
| Manage blue print of the house |  |
| Draw the blue print of the house |  |

|  |  |
| --- | --- |
| **Class: Page** | |
| Superclass of classes that represent various pages shown to the homeowner(user).  Each page has a unique id and draw its own UI page. | |
| **Responsibilities** | **Collaborators** |
| Draw it own UI page | FloorPlan, DeviceIcon, Button, Label, Textbox, and other related Java classes |

\*Note: Subclasses of pages are omitted in the CRC card because the variation between them is little or none from the page class.

|  |  |
| --- | --- |
| **Class: WebInterface** | |
| Interface between the system and the user when user uses the web browser to access the system. Sends user command to the system and shows response of the system to the user. Maintains pages shown to the user. | |
| **Responsibility** | **Collaborator** |
| Respond to button event from the pages | Page |
| Draw pages that are to be seen by the user | Page |
| Send message to system | System |
| Receive message from the system | System |
| Pass the information from the system to page | Page |
| Reads the data corresponding to the attributes from the database | StorageManager |
| Writes the data corresponding to the attributes to the database | StorageManager |

V. State Diagram

1. Classes around ConfigurationManager
2. State Diagram for ConfigurationManager



1. State Diagram for Log



1. State Diagram for LogManager



1. State Diagram for LoginInterface



1. State Diagram for LoginManager



1. State Diagram for SafetyZone



1. State Diagram for SafeHomeMode



1. State Diagram for StorageManager



1. State Diagram for SystemSettings



1. Classes around System (Device related)
2. State Diagram for Alarm



1. State Diagram for CameraController



1. State Diagram for MotionSensor



1. State Diagram for SafeHomeCamera



1. State Diagram for Sensor



1. State Diagram for SensorController



1. State Diagram for System



1. State Diagram for WindowDoorSensor



1. Classes around WebInterface
2. State Diagram for DeviceIcon



1. State Diagram for FloorPlan



1. State Diagram for Page



1. State Diagram for WebInterface



VI. Sequence Diagram

1. Common Sequence Diagram
2. Log onto the system through control panel



1. Log onto the system through web browser



1. Configure system setting



1. Turn the system on





Note: The duration of the life time of the classes created in this sequence diagram is as same as that of the system. However, due to the lack of space the life time line is indicated as if the class disappears immediately.

1. Turn the system off



1. Reset the system



1. Change master password through control panel



1. Security Sequence Diagram
2. Arm/disarm system through control panel



1. Arm/disarm system through web browser



1. Arm/disarm safety zone selectively



1. Alarm condition encountered



1. Configure safety zone



1. Create new safety zone



1. Delete safety zone



1. Update an exist safety zone



1. Configure SafeHome modes



1. View intrusion log



1. Call monitoring service through control panel



1. Surveillance Sequence Diagram
2. Display Specific camera view



1. Pan/Zoom specific camera view



1. Set camera password



1. Delete camera password





1. View thumbnail Shots



1. Enable camera



1. Disable camera



VII. Design evaluation

1. Architectural Design Metric
2. Design Structure Quality Index (DSQI)
   * S1 = 70
   * S2 = 30
   * S3 = 21
   * S4 = 16
   * S5 = 5
   * S6 = 5
   * S7 = 66
   * Program Structure: D1 = 1
   * Module independence: D2 = 1 - 30 / 70 = 40 / 70
   * Modules not depend on prior processing: D3 = 1 - 21 / 70 = 49 / 70
   * Database size: D4 = 1 - 5 / 16 = 11 / 16
   * Database compartmentalization: D5 = 1 - 5 / 16 = 11 / 16
   * Module entrance/exit characteristic: D6 = 1 - 66 / 70 = 4 / 70
   * W1 = 0.25
   * W2 = 0.3
   * W3 = 0.25
   * W4 = 0.05
   * W5 = 0.05
   * W6 = 0.1
   * DSQI = ∑WiDi = approximately 0.669
3. Fenton's simple morphology metrics
   * node = 70
   * arc = 71
   * size = 141
   * depth = 6
   * width = 21
   * arc-to-node ratio = 1.014
4. CK Metrics

|  |  |
| --- | --- |
| **Depth of the inheritance tree** | 2 |
| **Maximum Number of Children** | 13 (at Page class) |
| **Average Number of Children** | 0.429 |
| **Maximum Coupling Between Object classes** | 12 (at System class) |
| **Average Coupling Between Object classes** | 1.543 |

1. MOOD Metric
2. MIF (Method Inheritance Factor)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Md(Ci)** | **Mi(Ci)** | **Ma(Ci)** |
| **1** | Alarm | 5 |  | 5 |
| **2** | CameraController | 15 |  | 15 |
| **3** | ConfigurationManager | 8 |  | 8 |
| **4** | DeviceIcon | 14 |  | 14 |
| **5** | FloorPlan | 2 |  | 2 |
| **6** | Log | 6 |  | 6 |
| **7** | LogManager | 2 |  | 2 |
| **8** | LoginInterface | 19 |  | 19 |
| **9** | LoginManager | 3 |  | 3 |
| **10** | MotionSensor | 1 | 10 | 11 |
| **11** | Page | 6 |  | 6 |
| **12** | SafeHomeCamera | 16 |  | 16 |
| **13** | SafeHomeMode | 8 |  | 8 |
| **14** | SafetyZone | 9 |  | 9 |
| **15** | Sensor | 10 |  | 10 |
| **16** | SensorController | 10 |  | 10 |
| **17** | StorageManager | 4 |  | 4 |
| **18** | System | 15 |  | 15 |
| **19** | SystemSettings | 8 |  | 8 |
| **20** | WebInterface | 7 |  | 7 |
| **21** | WindowDoorSensor | 1 | 10 | 11 |
| **22** | SafeHomeControlPanel | 6 |  | 6 |
| **23** | LoginPage | 0 | 6 | 6 |
| **24** | SurveilancePage | 0 | 6 | 6 |
| **25** | CameraListPage | 0 | 6 | 6 |
| **26** | SingleCameraViewPage | 1 | 6 | 7 |
| **27** | ViewLogPage | 0 | 6 | 6 |
| **28** | ThumbnailViewPage | 1 | 6 | 7 |
| **29** | SecurityPage | 0 | 6 | 6 |
| **30** | SafeHomeModeConfigurePage | 0 | 6 | 6 |
| **31** | PhoneNumberValidationPage | 0 | 6 | 6 |
| **32** | MajorFunctionPage | 0 | 6 | 6 |
| **33** | ConfigureSystemSettingPage | 0 | 6 | 6 |
| **34** | SafetyZonePage | 0 | 6 | 6 |
| **35** | SafeHomeModePage | 0 | 6 | 6 |

**MIF = 98 / 275 = Approximately 0.356**

1. CF (Coupling Factor)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** |
| **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **2** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **5** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **6** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **7** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **8** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **9** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **10** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **11** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **12** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **13** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **14** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **15** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **16** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **17** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **18** | **1** | **1** | **1** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **19** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **20** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **21** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **22** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **23** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **24** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **25** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **26** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **27** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **28** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **29** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **30** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **31** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **32** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **33** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **34** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **35** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

\* Class numbering follows the table in VII. 3. a.

**CF = 51 / (35 \* 35 – 35) = 0.043**

1. OO Metric Proposed by Lorenz and Kidd

|  |  |  |  |
| --- | --- | --- | --- |
|  | **# of operation** | **# of atrribute** | **NOA** |
| Alarm | 5 | 4 |  |
| CameraController | 15 | 2 |  |
| ConfigurationManager | 8 | 0 |  |
| DeviceIcon | 14 | 7 |  |
| FloorPlan | 2 | 1 |  |
| Log | 6 | 3 |  |
| LogManager | 2 | 3 |  |
| LoginInterface | 9 | 19 |  |
| LoginManager | 3 | 0 |  |
| MotionSensor | 10 | 5 | 0 |
| Page | 6 | 1 |  |
| SafeHomeCamera | 16 | 7 |  |
| SafeHomeMode | 8 | 3 |  |
| SafetyZone | 9 | 4 |  |
| Sensor | 10 | 5 |  |
| SensorController | 10 | 2 |  |
| StorageManager | 4 | 7 |  |
| System | 15 | 4 |  |
| SystemSettings | 8 | 4 |  |
| WebInterface | 7 | 2 |  |
| WindowDoorSensor | 11 | 5 | 1 |
| SafeHomeControlPanel | 5 | 1 |  |
| LoginPage | 6 | 1 | 0 |
| SurveilancePage | 6 | 1 | 0 |
| CameraPage | 6 | 1 | 0 |
| CameraListPage | 6 | 1 | 0 |
| SingleCameraViewPage | 6 | 1 | 0 |
| ViewLogPage | 6 | 1 | 0 |
| ThumbnailViewPage | 6 | 1 | 0 |
| SecurityPage | 6 | 1 | 0 |
| SafeHomeModeConfigurePage | 6 | 1 | 0 |
| PhoneNumberValidationPage | 6 | 1 | 0 |
| MajorFunctionPage | 6 | 1 | 0 |
| ConfigureSystemSettingPage | 6 | 1 | 0 |
| SafetyZonePage | 6 | 1 | 0 |
| SafeHomeModePage | 6 | 1 | 0 |

1. General Evaluation of Goal

* Correctness
  + Class diagram based on extracted classes
  + Sequence diagram follows use case scenario
  + Review of our work using use case scenario
* coupling, cohesion, complexity, and maintainability
  + Division of external interface, device management, and data categories
  + Modularization
* Reusability and flexibility
  + Modularization
  + Try to use generally designed classes (e.g. login or data access)

VIII. Lessons Learned

* Importance of early stage work of software engineering process
* Well defined documentation
* Importance of preplanning
* Importance of team cooperation
* Difficulty of creating a good design

IX. Who did What

|  |  |
| --- | --- |
| **Sequence Diagram** | **Done by** |
| **Call monitoring service through control panel** | DongHyun Choi |
| **Disable camera** | Dong-Yun Yang |
| **Log onto the SafeHome System through web browser** | Pham Minh Duc |
| **Log onto the system through control panel** | Ji-Yong Shin |
| **Change master password through control panel** | Suraj Pandey |
| **Configure SafeHome modes** | Dong-Yun Yang |
| **configure system setting** | Pham Minh Duc |
| **View intrusion log** | Ji-Yong Shin |
| **Turn the system on** | DongHyun Choi |
| **Turn the system off** | Dong-Yun Yang |
| **Reset the system** | Pham Minh Duc |
| **Alarm condition encountered** | Ji-Yong Shin |
| **Arm/disarm system through control panel** | DongHyun Choi |
| **Arm/disarm system through web browser** | Dong-Yun Yang |
| **Arm/disarm safety zone selectively** | Pham Minh Duc |
| **Delete safety zone** | Ji-Yong Shin |
| **Update an exist safety zone** | Suraj Pandey |
| **Configure safety zone** | Dong-Yun Yang |
| **Create new safety zone** | Pham Minh Duc |
| **Set camera password** | Ji-Yong Shin |
| **Delete camera password** | DongHyun Choi |
| **Display Specific camera view** | Suraj Pandey |
| **Pan/Zoom specific camera view** | Pham Minh Duc |
| **View thumbnail Shots** | Ji-Yong Shin |
| **Enable camera** | Suraj Pandey |

|  |  |  |
| --- | --- | --- |
| **Class** | **State Diagram** | **CRC Card** |
| **Alarm** | DongHyun Choi | DongHyun Choi |
| **CameraController** | Dong-Yun Yang | DongHyun Choi |
| **ConfigurationManager** | Ji-Yong Shin | DongHyun Choi |
| **DeviceIcon** | Ji-Yong Shin | DongHyun Choi |
| **FloorPlan** | Pham Minh Duc | Dong-Yun Yang |
| **Log** | DongHyun Choi | Suraj Pandey |
| **LogManager** | Pham Minh Duc | Suraj Pandey |
| **LoginInterface** | DongHyun Choi | Suraj Pandey |
| **LoginManager** | DongHyun Choi | Suraj Pandey |
| **MotionSensor** | DongHyun Choi | Dong-Yun Yang |
| **Page** | Ji-Yong Shin | Dong-Yun Yang |
| **SafeHomeCamera** | Dong-Yun Yang | Dong-Yun Yang |
| **SafeHomeMode** | Pham Minh Duc | Pham Minh Duc |
| **SafetyZone** | Pham Minh Duc | Pham Minh Duc |
| **Sensor** | DongHyun Choi | Pham Minh Duc |
| **SensorController** | DongHyun Choi | Pham Minh Duc |
| **StorageManager** | Pham Minh Duc | Suraj Pandey |
| **System** | DongHyun Choi | Ji-Yong Shin |
| **SystemSettings** | DongHyun Choi | Ji-Yong Shin |
| **WebInterface** | Pham Minh Duc | Ji-Yong Shin |
| **WindowDoorSensor** | DongHyun Choi | Ji-Yong Shin |

Common Work Done:

* Extraction of classes
* Creation of class diagram
* Review of class diagram
* Review of CRC card
* Review of state diagram
* Review of sequence diagram

Individual work Done:

* Dong Hyun Choi:
  + CK metric evaluation
  + Mood metric evaluation
  + Integrating document
* Dong Yun Yang:
  + OO Metric evaluation by Lorenz and Kidd
  + Refactoring state diagram
  + Refactoring class diagram
* Pham Minh Duc:
  + Refactoring sequence diagram
* Ji Yong Shin:
  + Writing an overview
  + Architectural structure & diagram
  + Architectural design metric evaluation
  + Refactoring class diagram
* Suraj Pandey
  + Refactoring class diagram