Requirements for

Smart Home Guard System

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Contents

Figure & Table

Revision History

Doc. Name	Date	Reason For changes	Version
Requirements	1st of October	Initial version of Requirements	V 0.1
Requirements	3rd of October	Description of goal	V 0.2
Requirements	5th of October	Description of Requirements analysis	V 0.3
Requirements	9th of October	Korean version of Requirements	V 0.4
Requirements	13th of October	Complete version of Requirements	V 1.0

Table 1. Revision History

1. Project Overview

The population that live alone is increasing rapidly. This is mainly because the twenties tend to be "Sampo generation" who gives up courtship, marriage and childbirth. According to the Korea National Statistical Office, the ratio of single household is 23.9 percent in 2012, compared to 9.0 percent in 1990. The most recent research, which is conducted in August 2015, shows 26.0 percent of single household ratio, and it looks to be 34.3 percent in 2035 [1].

There is the other statistics that conducted a research on single household of women from 25-year-old to 49-year-old living in Seoul. It is conducted by Seoul municipal office with Ministry of Gender Equality and Family. The characteristics of single family is the highest portion is in elder people above 60 ages, and the portion of women increased a little from 66.1 percent in 2010 to 69.0 percent in 2014 [1].
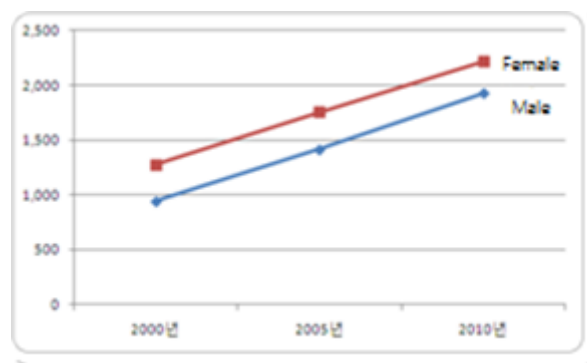
Figure 1. The rate of "Single household" is 23.9 percent in 2012, Rate of female is higher than male [1]

Private security guards said that the most unsafe areas are daycare center, institution for people with disabilities, and single-women household. They said there is need to strengthen social security system, because the crime for the weak is increasing. The majority of security guards said that the most urgent people are the women who live alone [2].

While the single household has been increased, consumption for them has been too increased. Also, a neologism was economically formed which is called "Solo Economy". However, crimes which is targeting the single household has increased [3].
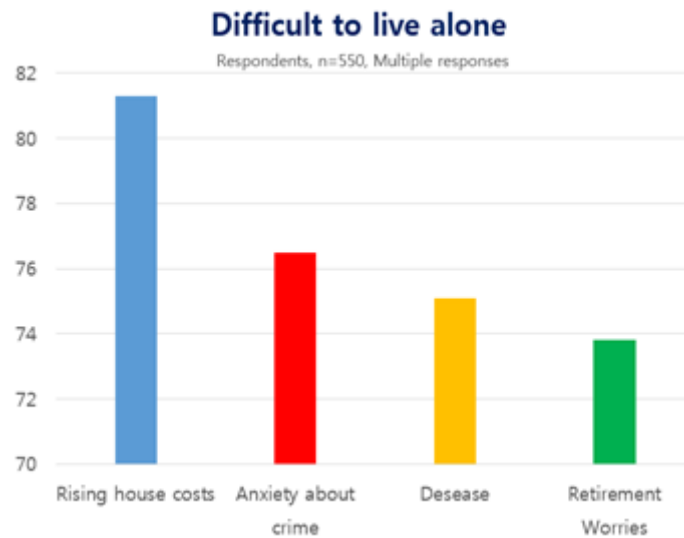
Figure 2. Seoul Foundation of Women & Family, Difficult to live alone. 2012 [3]

When asked a question 'Difficult to live alone', women responded that "Anxiety about crime, such as sexual assault" secondly high. That is, women who live alone are feeling uneasy. Due to the relentless news about female crime, they would anxious a lot. The crime for women who live alone is really happened much?

Figure 3. 45 people of 357 people among the female Single household in Seoul [3]

From the 20-year-old to the 50-year-old woman hit 12.6 percent of 357 respondents replied that the case went through the crime or injury. Also, they hit about 80 percent near the house (around the building (39 percent), inside building (29.3 percent) and in the home (19.5 percent)). This mean that about 13 women out of every 100 people living alone suffered crime. It was higher than previously thought. Now that most of the crimes occur near the house, even what women living

alone sleep fitfully is not an idle fear. The most comfortable and safe home more than anything that you need to place surely that cannot shake the "anxiety" is ironic [3].

In spite of the implementation of "women assured home services" and "women assured courier service" currently in Seoul, which is not enough to be away from crime. Surged the single household and sending most of the day while the house is empty for a long time for the company, a crime aiming for the elderly and socially disadvantaged women by increasing. So, it requires the introduction of the institutional system to prevent this kind of crime.

1.1. Objectives

Socially the "Single Household" has increased dramatically. Socially the "Single Household" has increased dramatically. It is necessary to prevent unexpected intrusion, that causes greater damage and to get away from crime for women and the elderly. For this reason, we propose a "Smart Home Guard System (SHGS)" that prevents the sneak thief and sex crimes targeting women. And also, this system makes user control the house conveniently while they are out of the home.

1.1.1. Away from Home

During absence, Smart Home Guard System prevent crime target by controlled like someone in the house. When did intrusion detection, the attacker cannot get out of the house by lock is operated. So, police can catch the crime scene in the meantime.

- Lock the front door and windows by TIZEN phone through the wireless [4]

- Turn on the TV and lighting as people at home

- If someone ring a doorbell, user can watch a video of front door and talk over TIZEN phone

- If intrusion is detected, lock the front door and windows, and report to the police

1.1.2. Stay at Home

When user is at home, system is on Half-Lock Mode. It doesn't detect the motion in house. When it detect external intrusion, it reports to the police and family for preventing the bigger crime.

- System Half-Lock Mode on

- When it detect external intrusion, report the warning to the police and family

1.2. Scope

Figure 4 and Figure 5 represent the conceptual framework of the Smart Home Guard System and the scenario flowchart of the Smart Home Guard System, respectively. Our system consists of Raspberry Pi for main server and calculations, Arduino Uno for getting sensor values, and TIZEN Application for user's controller.

The Smart home Guard System is the core of the Home-IoT technologies which are sensing an activity of household, real time streaming for sending a video to user who has TIZEN phone and so on.

Figure 4. Conceptual Framework of the Smart Home Guard System

Figure 5. Scenario Flowchart of the Smart Home Guard System

1.3. Supplementary Requirements

We derived the Functional Requirement Goal and Non-Functional Requirement Goal for Safety Home Guard System.

1.3.1. Goal-graph Legend

Goal Graph were created using the iStar UML [5]. Legend is as follows:

Figure 6. Legends of Goal-graph

1.3.2. Goal-graph of Stakeholders

We defined stakeholders of the SHGS: Government, Organization (where to apply the SHGS to an organizational unit such as, apartment, office building, etc.), Developer, Telecommunication Company, and the SHGS User.

Figure 7 shows a Goal-graph of Requirements for each stakeholder.
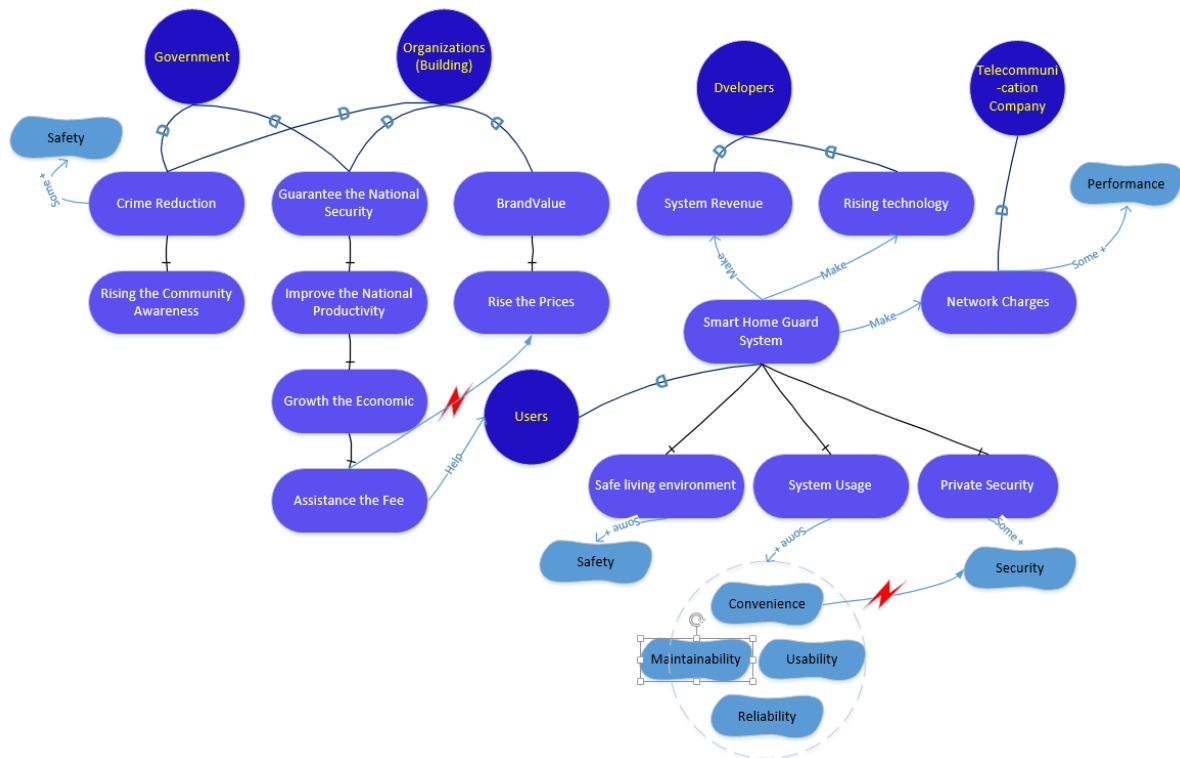
Figure 7. Goal-graph of Requirements for each stakeholder

1.3.3. Goal-graph of the Smart Home Guard System

We represented the Sub-Goal and Task of implementing SHGS, based on the Goal derived from the above Stakeholder Requirement Goal.
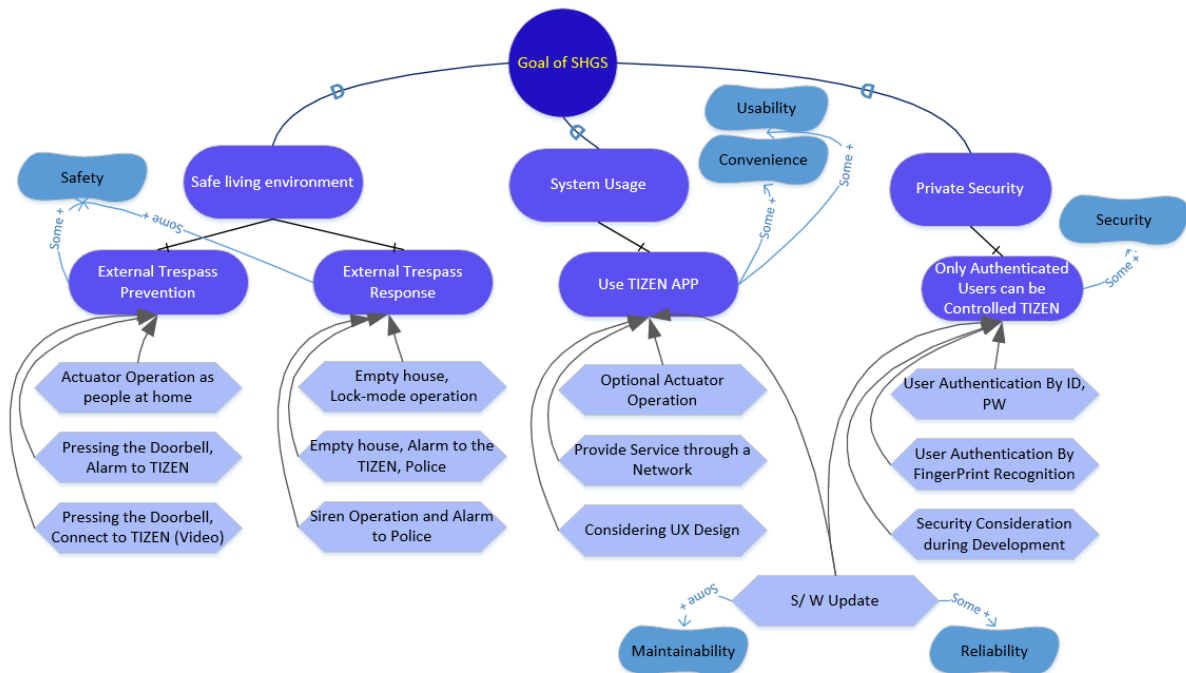
Figure 8. Goal-graph of the Smart Home Guard System Requirements

1.3.4. Non-Functional Requirements

It arranged the relationship between the Non-Functional Requirement in SHGS. The system includes the properties of the Safety, Security, Performance, Convenience, Usability, Reliability, and Maintainability. We consider the interaction with the Functional Requirements and Non-Functional Requirements of the system.
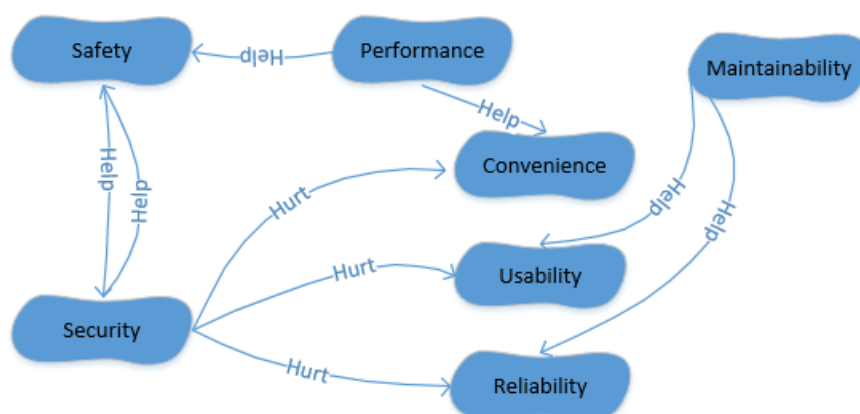
Figure 9. Non-Functional Requirements in System Requirements

1.3.4.1.   Safety

This Non-Functional Requirements consider that it may arise damage with bodily, physical, assets. It includes sub-goals and tasks. It includes various substantially corresponds to the task and intrusion prevention for housing.
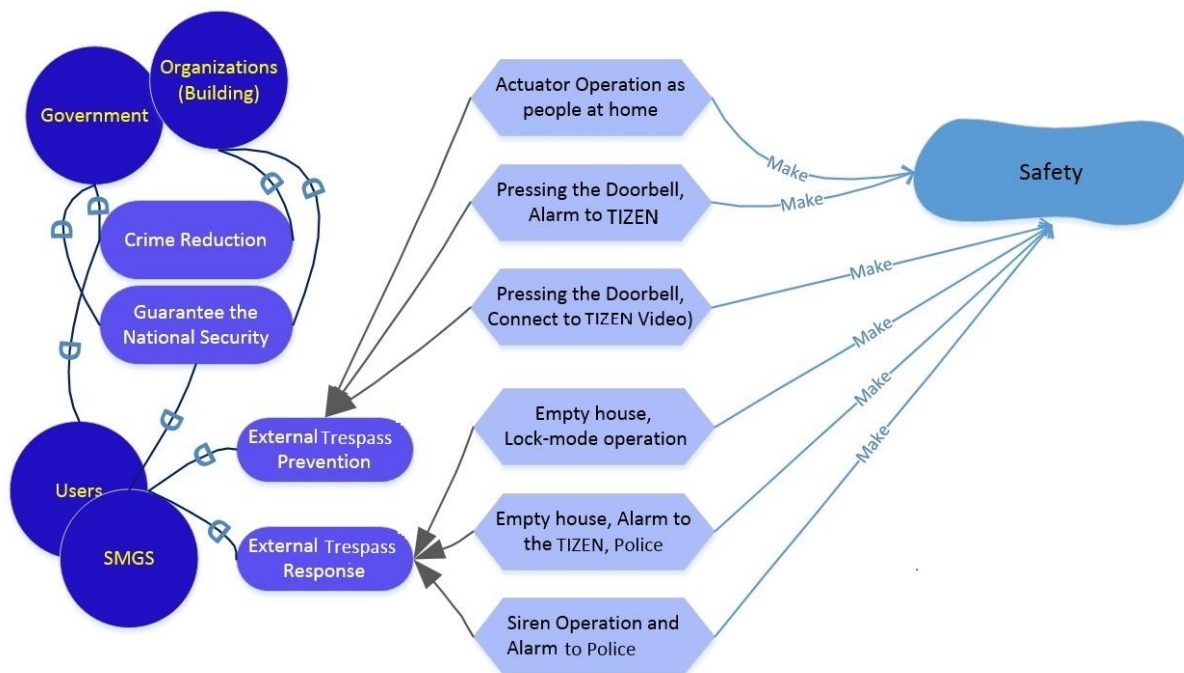
Figure 10. Mapping related tasks of goal with Safety

1.3.4.2.   Security

This Non-Functional Requirements, the system is available only to certified user. The unauthorized user has possession of that could be exploited by using the TIZEN Phone. Therefore, the user can control the SHGS by enter the authentication data (ID, Password). If TIZEN Phone would upgrade with Finger Print Module, Finger Print recognition shall be as user authentication TIZEN App. And it embraces a malicious user to prepare the system hacking, considering the SWASP [6] and development.
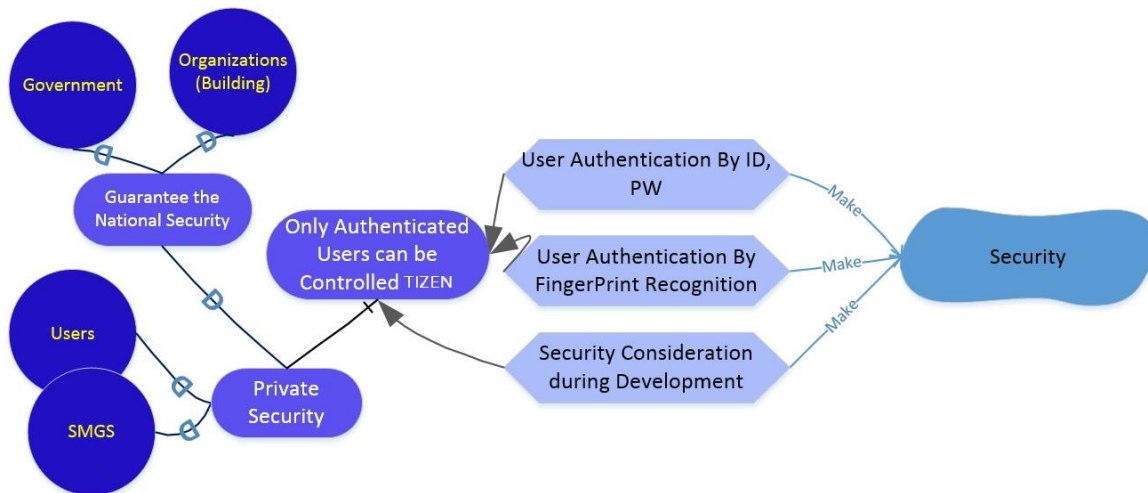
Figure 11. Mapping related tasks of goal with Security

1.3.4.3.　Performance

Because the SHGS is service using mobile phone, it is important that you can use the network anytime, anywhere. It provides quick and correct services through the telecommunication network for without delay.
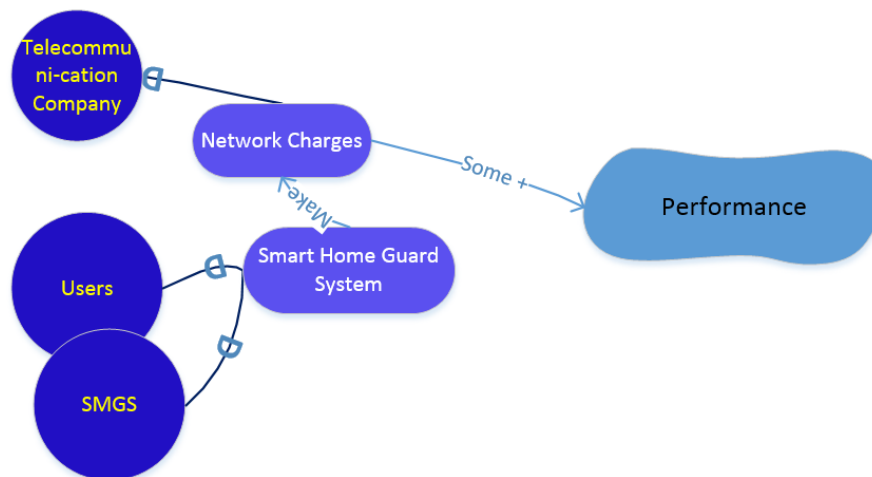
Figure 12. Mapping related tasks of goal with Performance

1.3.4.4.　Convenience, Usability and Reliability

Even though the service is safe and good performance, the Users will not be used the service

without Convenience, Usability, and Reliability. SHGS provides Convenience, Usability attributes through the "User Experience Design, Optional Actuator Operation, Provide Service through a network" task. It provides Reliability and Security Properties via a continuous S/W Update task.

However, there is conflict between convenience attributes and security attributes that require user authentication. The current system provides the user authentication via ID, Password. In the future, using Fingerprint authentication will provide a little more convenient authentication for the user.
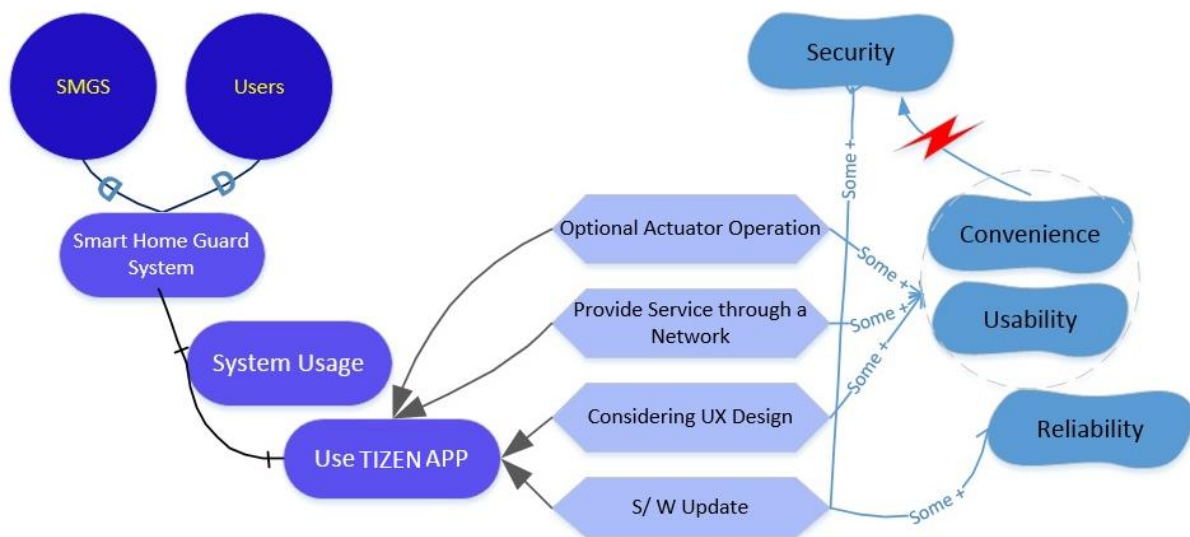
Figure 13. Mapping related tasks of goal with Convenience, Usability, Reliability and conflict with Security

1.3.4.5.   Maintainability

The SHGS applies the S/W and Security Patch for Maintainability of the system. It is also an important task for the Reliability of the system.
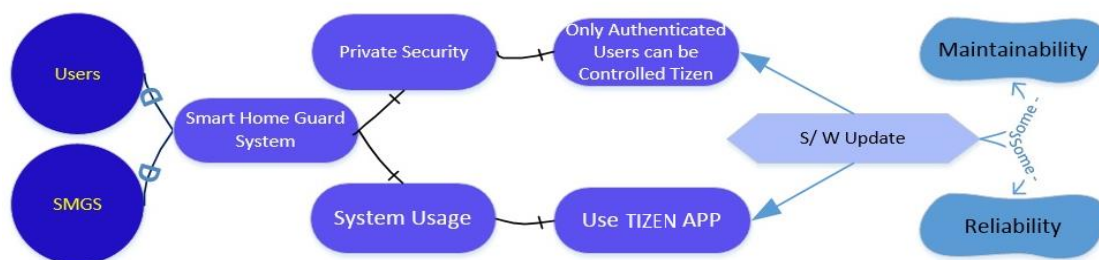
Figure 14. Mapping related task of goal with Maintainability

2. Customer Requirements

2.1. Actor
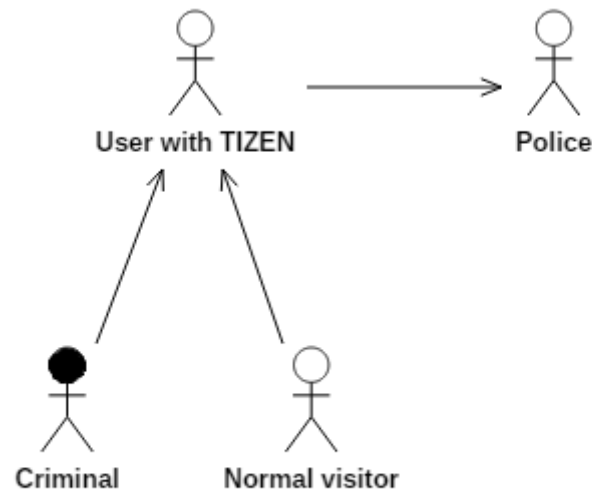
Figure 15. Identification of Actors of the Smart Home Guard System

2.1.1. User with TIZEN

This is the user of the system. They have TIZEN device that controls the SHGS and contacts with the Police.

2.1.2. Normal visitor

Normal visitor is a trusted person based on user actor. They do not affect abnormal.

2.1.3. Criminal

Criminal has an adverse effect on the SHGS.

2.1.4. Police

Police can be a police station or a security office if user live in a small apartment. They receive user's request or request of the system.

2.2. Essential Use Case Model
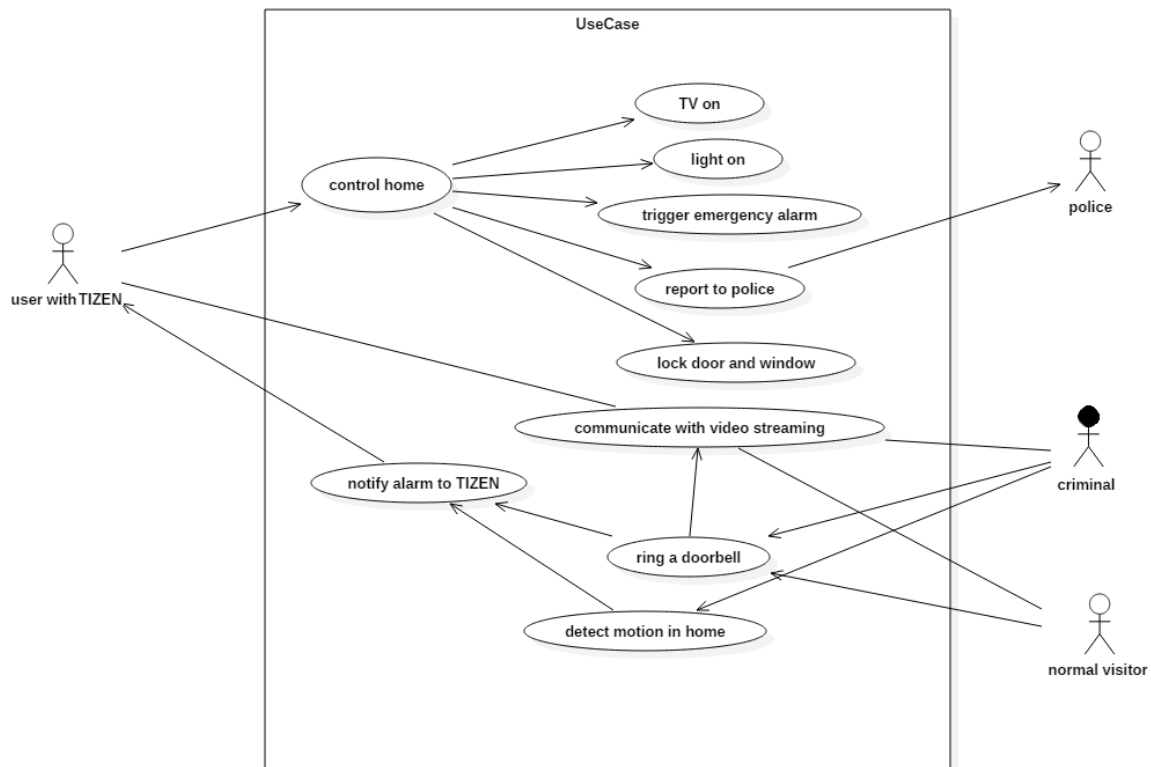
Figure 16. Essential Use Case Model of the Smart Home Guard System

We made use case description based on the use case diagram. UC001 through UC006 include description and scenario that can happen with SHGH.

Use Case #	UC001
Precondition	User is not at the home.
Description	1. User wants to pretend that there is someone at home. 2. User executes mobile application installed on TIZEN. 3. User turn on TV and volume up TV 4. User turn the light on. 5. If user want to change the status of the above, he can control them with TIZEN.
Exceptions	The charge in battery is low.
Post-condition	The thief or criminal gives up invading, because he saw the light wink on.

Scenario	Lily is a woman that live alone and work in Electronics Company. She bought 'Smart Home Guard System (SHGS)' of which purpose is preventing intrusion in house. Lily usually controlled the house by SHGS when she was at work. It means that she usually made TV and light turned on. (When it is needed, she turned TV volume up.)

Use Case #	UC002
Precondition	User is not at home at night, and someone visit home. User can check phone alarm.
Description	1. User is carrying his phone. 2. Normal visitor visits user's home. 3. Visitor pressed a doorbell. 4. A notification alarm arrives on the user's phone. 5. User presses 'confirm' button on the phone's screen. 6. User confirm who the visitor is and converse with him. 7. And then, user can deal with the reason why the visitor has visited.
Exceptions	User cannot check the phone's notification alarm.
Post-condition	User has settled the matter which the visitor wanted to talk.
Scenario	One day, Lily received TIZEN smartphone notification, when working at her company. So, she pressed a 'confirm' button and she could watch video. The visitor was a parcel delivery man. She pressed 'talk' button and she said that please hand over the parcel to the janitor's office.

Use Case #	UC003
Precondition	User's home is empty with light and TV turned off. And also, someone visits home. User can check phone alarm.

Description	1. User went out of the home at night.
	2. User is carrying his phone.
	3. A malicious visitor visits user's home.
	4. Visitor pressed a doorbell.
	5. A notification alarm arrives on the user's phone.
	6. User presses 'confirm' button on the phone's screen.
	7. User confirm the person who the visit home and notice it stinks.
	8. User locks the door and windows.
Exceptions	User cannot check the phone's notification alarm.
Post-condition	User prevented the malicious visitor's trial of trespass.
Scenario	One night, Lily's department was having a get-together. Therefore, she forgot to turn on the light and TV in the house. And then, TIZEN smartphone received a notification that somebody visited her home. By watching the video using TIZEN smartphone, she could know that a man wearing a mask is standing in front of the door. Lily was so astonished. By using Tizen, She locked the front door and the windows and asked who you are at this time of night. And the man suddenly disappeared.

Use Case #	UC004
Precondition	User is not at home. And also, someone visits home. User cannot check phone alarm.
Description	1. User is not able to check his phone's notification alarm.
	2. A malicious visitor visits user's home.
	3. Visitor pressed a doorbell.
	4. A notification alarm arrives on the user's phone.
	5. User cannot confirm the notification.
	6. The pre-configured functions are automatically executed. The pre-configured functions can always be settled differently.
	7. The malicious visitor cannot enter into user's home.

Exceptions	There is no special exception.
Post-condition	User prevented the malicious visitor's trial of trespass.
Scenario	One day, Lily was in project meeting at work. The TIZEN smartphone is in her bag and Lily could not recognize the phone notification. At that time, the TIZEN smartphone received a notification. Consequently, Lily could not confirm the notification. Automatically, the functions that Lily had configured in advance are executed. The front door and the windows are locked. And, TV and light was turned on. After meeting, she saw that the notification had been received. The man who had visited before was hanging around the house. Lily was afraid and angry.

Use Case #	UC005
Precondition	User is not at home. And also, window remains open.
Description	1. While user is out of home, the window is opened. 2. User's phone receive an emergency alarm. 3. Alarm say that the motion is detected at home. 4. The police arrive at user's home. 5. The user arrive at home. 6. The police open the door with user's phone and enter into home. 7. The police arrest the thief.
Exceptions	There is no special exception.
Post-condition	Thief was arrested.
Scenario	One day, Lily overslept and forgot to close the windows. She was working at 3 p.m. And then, suddenly, her TIZEN smartphone received that the motion in the house is detected. She was astonished and went to home. And, there were many people. Passers-by simply looked on. And also, the policemen are in front of the door. She checked what the matter is. The matter was that the man who had visited and wearing a mask was in the house. The man was trapped in the

	house. It is because the SHGS had locked all the windows and the front door. And, SHGS reported to the police and trigger a noisy alarm in front of the door. Therefore many people were looking on. Lily had the only device that could unlock the front door. It was her TIZEN smartphone. The policemen opened the door with it, and enter into the house. After getting into hand-to-hand fight with the man, the policemen arrested him. Lily was very relieved that she had equipped with Smart Home Guard System.

Use Case #	UC006
Precondition	User is sleeping.
Description	1. User is sleeping. 2. A thief try to open the door forcibly. 3. The pre-configured functions are automatically executed. 4. Because of the system's functions, the thief cannot enter into use's home.
Exceptions	There is no special exception.
Post-condition	System prevented the malicious visitor trespass into the user's home.
Scenario	One day, a thief tried to trespass at night by open the door forcibly. However, the door could sense trial to open the door, so the SHGS activated various functions. The alarm was triggered and the report was reported to the police. And also, the photo of the thief was saved. The thief had been fled. However, the police started to openly search for the thief based on photo information.

2.3. Proposed Scenario

■ Actor   ■ Background / Domain   ■ Goal / Objective

We made the integrated full scenario that shows actor, background/domain, goal/objective by using different color.

Lily is a woman that live alone and work in Electronics Company. She bought 'Smart Home Guard System (SHGS)' of which purpose is preventing intrusion in house. Lily usually controlled the house by SHGS when she was at work. It means that she usually made TV and light turned on. (When it is needed, she turned TV volume up.)

One day at no distant date, Lily received TIZEN smartphone notification, when working at her company. So, she pressed a 'confirm' button and she could watch video. The visitor was a parcel delivery man. She pressed 'talk' button and she said that please hand over the parcel to the janitor's office.

The same day night, her department was having a get-together. **Therefore**, she forgot to turn on the light and TV in the house. And then, TIZEN smartphone received a notification that somebody visited her home. By watching the video using TIZEN smartphone, she could know that a man wearing a mask is standing in front of the door. Lily was so astonished. By using TIZEN, she locked the front door and the windows and asked who you are at this time of night. And the man suddenly disappeared.

The following day, she was in project meeting at work. The TIZEN smartphone is in her bag and Lily could not recognize the phone notification. At that time, the TIZEN smartphone received a notification. Consequently, Lily could not confirm the notification. Automatically, the functions that Lily had configured in advance are executed. The front door and the windows are locked. And, TV and light was turned on. After meeting, she saw that the notification had been received. The man who had visited yesterday was hanging around the house. Lily was afraid and angry.

Next day, Lily overslept and forgot to close the windows. She was working at 3 p.m. And then, suddenly, her TIZEN smartphone received that the motion in the house is detected. She was astonished and went to home. And, there were many people. Passers-by simply looked on. And also, the policemen are in front of the door. She checked what the matter is. The matter was that the man who had visited and wearing a mask was in the house. The man was trapped in the house. It is because the SHGS had locked all the windows and the front door. And, SHGS reported to the police and trigger a noisy alarm in front of the door. Therefore many people were looking on. Lily had the only device that could unlock the front door. It was her TIZEN smartphone. The policemen opened the door with it, and enter into the house. After getting into hand-to-hand fight with the man, the policemen arrested him. Lily was very relieved that she had equipped with Smart Home Guard System.

And in some future, another thief tried to trespass at night by open the door forcibly. However, the door could sense trial to open the door, so the SHGS activated various functions. The alarm was

triggered and the report was reported to the police. And also, the photo of the thief was saved. The thief had been fled. However, the police started to openly search for the thief based on photo information.

3. Requirements Analysis

3.1. Structural Analysis

3.1.1. Structural chart for the Smart Home Guard System
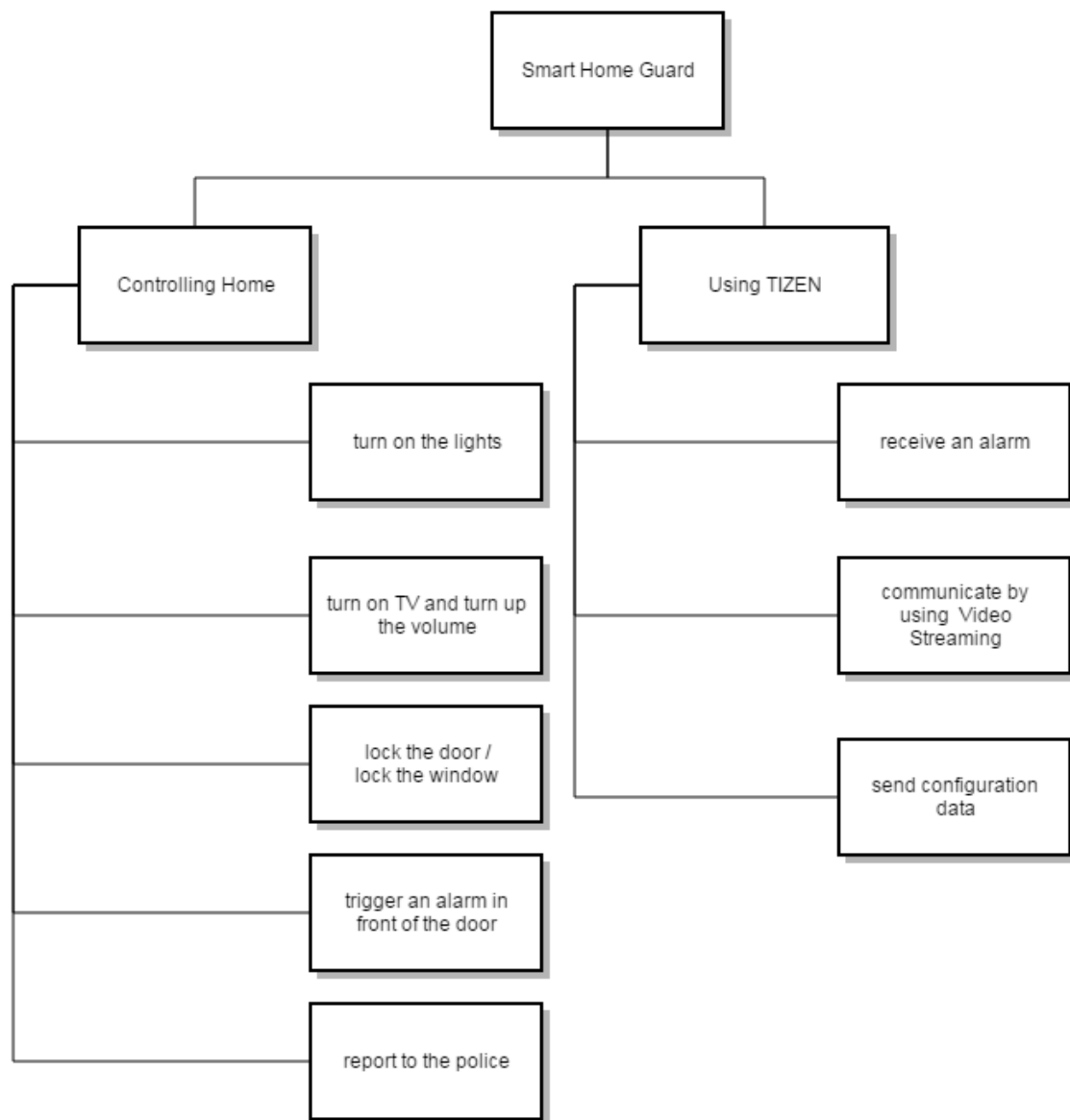
Figure 17. Structural chart for the Smart Home Guard System

Figure 17 represents the hierarchical structure of our SHGS. In controlling home part, there are Raspberry Pi and Arduino, which are controlled by TIZEN devices. Also, it can control inner sensors and actuators through them and Raspberry Pi reports on the environment to the user and the police. In Using TIZEN, TIZEN gets the environment from controlling home part and takes action.

Also, it sends configuration data to Controlling home to control them.

3.1.2. Class Diagram
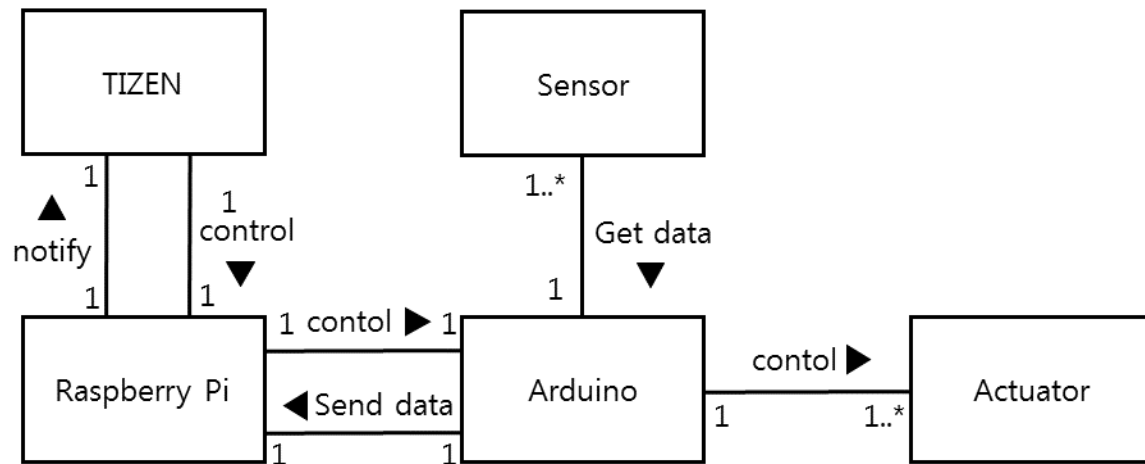
Figure 18. Class diagram for the Smart Home Guard System

These Class diagram figure 18 aims to describe the important relation and the streams between classes which are TIZEN, Raspberry Pi and Arduino. In TIZEN class, the user receives the alarm from Raspberry Pi and sends the command to Raspberry Pi. Raspberry Pi sends analyzed data from user's command to Arduino and on the other way Raspberry Pi performs that it receives the sensor data or actuator action from Arduino, analyses them, and sends the alarm to TIZEN. Lastly, Arduino performs sending the command from Raspberry Pi to actuators and on the other way sending the values from sensors which are connected to Arduino to Raspberry Pi.

3.2. Behavioral Analysis
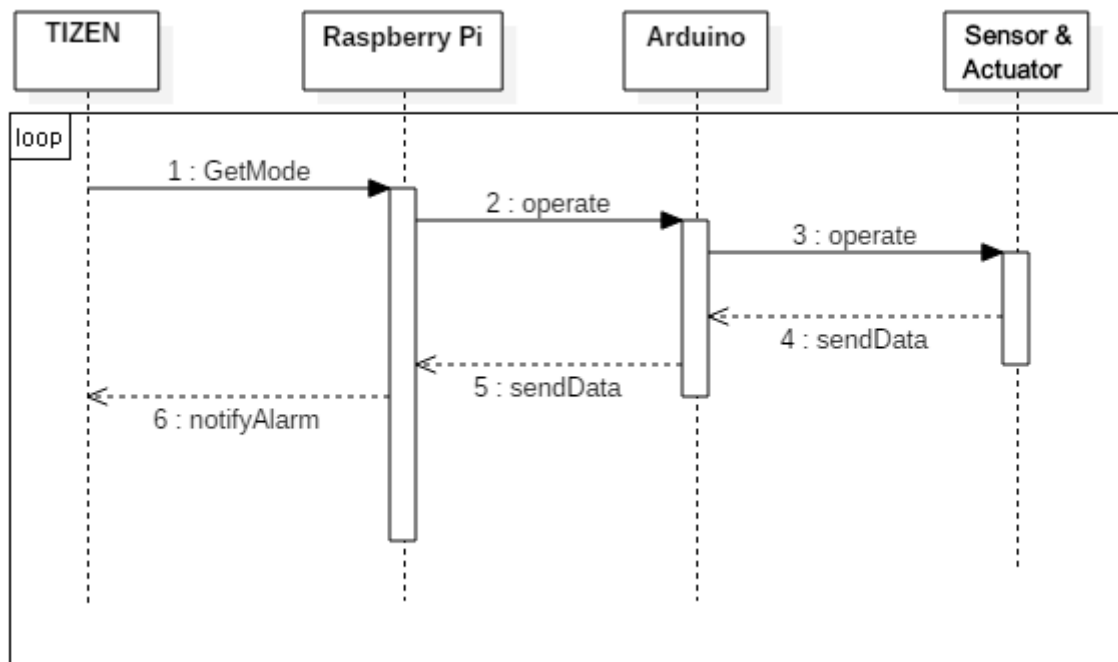
Figure 19. Sequence diagram for the Smart Home Guard System

These sequence diagram figure 19 represents sequence diagram of the SHGS. Our system is loop shape that there are no starting point and end point. Basically, the system behave from the mode which is user's set-up on TIZEN, from TIZEN to actuators. Also, Arduino receives the value from sensors, Raspberry Pi analyses the data from Arduino and TIZEN receives the notification from Raspberry Pi, from sensor to TIZEN. It means that it can be processing from TIZEN to actuators and from sensors to TIZEN.

3.3. Analysis Packages
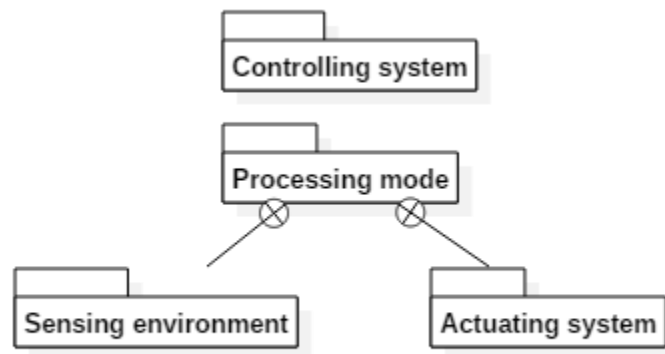
Figure 20. Packages for the Smart Home Guard System

3.3.1. Controlling system

This package contains Functional Requirements that TIZEN control the SHGS.

3.3.2. Processing mode

This package contains Functional Requirements that can process the control of TIZEN or the sensor values delivered from Arduino.

3.3.3. Sensing environment

This package contains Functional Requirements that can send the sensing data from sensors which are connected to Arduino.

3.3.4. Actuating system

This package contains Functional Requirements that can perform the action of actuators through the control from Arduino.

4. Risk analysis

We analyze the Risk early in the Development Process. This analysis may not contain all the risk but, this is used to manage the project risks.   Below is a list of risk factors for analysis Risk analysis.

Life Cycle	Possible Risks	Probability[1]
Development	If we do not use a commercially available Door-lock because of high prices, if not impossible to use a high price, it should implement the Door-lock that can be controlled by App. It will occur if we do not implement the Door-lock.	High
	When someone press the doorbell at the Door, which is the Video Streaming feature that calls the user's TIZEN Phone. We can implement a video device.	Very High
	Difficult to implement the Sensor Sensing and Control.	Medium
	All team members has no experience at TIZEN.	Very High
	Team has other courses and responsibilities.	High
Deployment	When an intruder breaking demolishing Door-lock.	Medium
	The user can lose their TIZEN phone.	Medium
	If they cannot control the SHGS by TIZEN phone because of the network is unstable.	Low

Table 2. Identified Risk table

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[1] The probability of the risk: Low (<25%), Medium (25-50%), High (50-75%), or Very High (>75%)

5. Validations Criteria (metrics & measures)

5.1. Check List

5.1.1. Functional Check List

It enumerates the crucial functions for SHGS.

Category	TIZEN	Test ID	FC_001	Requirement ID		TIZEN_Req	
No	Scenario			Response (Y, N, N/A)	Tester	Description	Note
1	TIZEN should accept notification well						
2	TIZEN should have secure network communication function by using 3G						
3	Only the authorized owner can TIZEN						
4	There should not be any delay of video streaming						
Category	Raspberry Pi	Test ID	FC_002	Requirement ID		Rasp_Req	
No	Scenario			Response (Y, N, N/A)	Tester	Description	Note
1	Raspberry should process all the data in a second						
2	Raspberry should be running 24 hours(always)						
3	Raspberry should run in a consecutive time more than 24 hours						
Category	Arduino Uno	Test ID	FC-003	Requirement ID		Ardu_Req	
No	Scenario			Response (Y, N, N/A)	Tester	Description	Note
1	Arduino should exactly detect the motion						
2	There should not be any error that cause emergency alarm						
3	Arduino should run in a consecutive time more than 24 hours						

Table 3. Functional Check List

5.1.2. Qualitative Check List

It enumerates the crucial qualities for SHGS.

Evaluation Item	Item to Examine	Score 5	4	3	2	1	Note
Understandability (5)	✓ Can readers of the document understand what the requirements mean?						
Redundancy (5)	✓ Is information unnecessarily repeated in the requirements document?						
Completeness (5)	✓ Does the checker know of any missing requirements or is there any information missing from individual requirement descriptions?						
Ambiguity (10)	✓ Are the requirements expressed using terms which are clearly define?						
	✓ Could readers from different backgrounds make different interpretations of the requirements?						
Consistency (10)	✓ Do the descriptions of different requirements include contradictions?						
	✓ Are there contradictions between individual requirements and overall system requirements?						
Organization (10)	✓ Is the document structured in a sensible way?						
	✓ Are the descriptions of requirements organized so that related requirements organized so that related requirements are grouped?						
Conformance to standards (10)	✓ Does the requirements document and individual requirements conform to defined standards?						
	✓ Are departures from the standards, justified?						
Traceability (5)	✓ Are requirements unambiguously identified, include links to related requirements and to the reasons why these requirements have been included?						
		Total Score :					**/ 60**

Total Discussion :

Table 4. Qualitative Check List

5.1.3. Use Case Check List

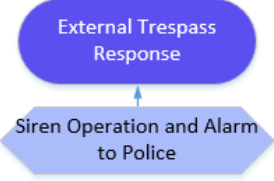| |
|---|
| 1. **The use-case name is meaningful and un-ambiguous** |
| [0] 1.1 Does the use case have a unique name? |
| [0] 1.2 Is the name a verb + noun phrase (for example, Withdraw Cash)? |
| [0] 1.3 Does the name accurately summarize the main goal of the use case? |
| [0] 1.4 Is the name "actor independent"? |
| 2. **The brief description clearly describes the primary goal of the use case** |
| [0] 2.1 Is it clear from the brief description what the main purpose of the use case is? |
| [0] 2.2 Is the "observable result of value" obvious? |
| 3. **Associated actors and information exchanged are clearly defined** |
| [0] 3.1 Is the use case associated with one or more actors? |
| [0] 3.2 Is the primary, or initiating actor, defined? |
| [0] 3.3 Is it clear who wishes to perform the use case? |
| [0] 3.4 Is all information exchanged between the actor(s) and the system clearly specified? |
| [0] 3.5 If a "time" actor is used, are you sure you did not miss an important actor and associated use cases (such as administrative or maintenance personnel that define schedule events)? |
| 4. **Pre-conditions have been specified** |
| [0] 4.1 Does each pre-condition represent a tangible state of the system (for example, the Withdraw Cash use case for an automated teller machine has a precondition that the user has an account)? |
| 5. **The Basic Flow and Alternate Flows are complete, correct and consistent** |
| [0] 5.1 Is it clear how the use case is started? |
| [0] 5.2 Is the triggering event clearly described? |
| [0] 5.3 Does the flow have a definite ending? |
| [X] 5.4 Does each step in the scenario contain the same level of abstraction? |
| [0] 5.5 Does each step in the scenario describe something that can actually happen and that the system can reasonably detect? |
| [0] 5.6 Does each step make progress towards the goal? |
| [0] 5.7 Are there any missing steps? Is it clear how to go from one step to the next? Does the sequence of communication between the actors and the use case conform to the user's expectations? |
| [0] 5.8 Does each step describe how the step helps the actor achieve their goal? |
| [0] 5.9 Is each step technology independent? Is it free of technical details, and design decisions? |
| [0] 5.10 Are the steps correctly numbered? |
| [0] 5.11 For each alternate flow is the condition(s) for initiation of the flow clearly defined? |
| [0] 5.12 For each alternate flow is it clear how the use case ends or where in the basic flow that the use case resumes? |
| 6. **Post-conditions have been specified** |
| [0] 6.1 If "Minimal Guarantees" are present, do they always happen when the use case completes, regardless of success? (A Minimal Guarantee represents a condition that will be true when the use case ends, regardless of how it terminates.) |

[0] 6.2 If "Success Guarantees" are present, do they always happen when the use case completes successfully? (A Success Guarantee represents a condition that will be true when the use case ends successfully, regardless of which path it takes.)	
7. **Applicable non-functional requirements have been captured**	
[0] 7.1 Are non-functional requirements (such as performance criteria) that are applicable to the use case captured in the use case?	
[0] 7.2 Are these non-functional requirements applicable to many use cases? It they are, consider capturing them in the system-wide requirements specification to simplify maintenance.	

Table 5. Use Case Check List [7]

5.2. Traceability Table

We have to keep track of the exact requirement, and creating a table tracking requirements.

NO	Function	Goal Graph	Use Cases
1	Actuator Operation as People at home	External Trespass Prevention / Actuator Operation as people at home	UC001
2	Pressing the Doorbell, Alarm to TIZEN	External Trespass Prevention / Pressing the Doorbell, Alarm to Tizen	UC001, 002
3	Pressing the Doorbell, Connect to TIZEN (Video)	External Trespass Prevention / Pressing the Doorbell, Connect to Tizen(Video)	UC003
4	Empty house, Lock-mode operation	External Trespass Response / Empty house, Lock-mode operation	UC004
5	Empty house, Alarm to the TIZEN and Police	External Trespass Response / Empty house, Alarm to the Tizen, Police	UC005

6	Siren Operation and Alarm to the Police		UC006
7	Optional Actuator Operation		UC001
8	User Authentication by ID, PW		UC001~006

Table 6. Functional Requirements Traceability Table

6. Appendices

6.1. Project Status

6.1.1. Gantt chart

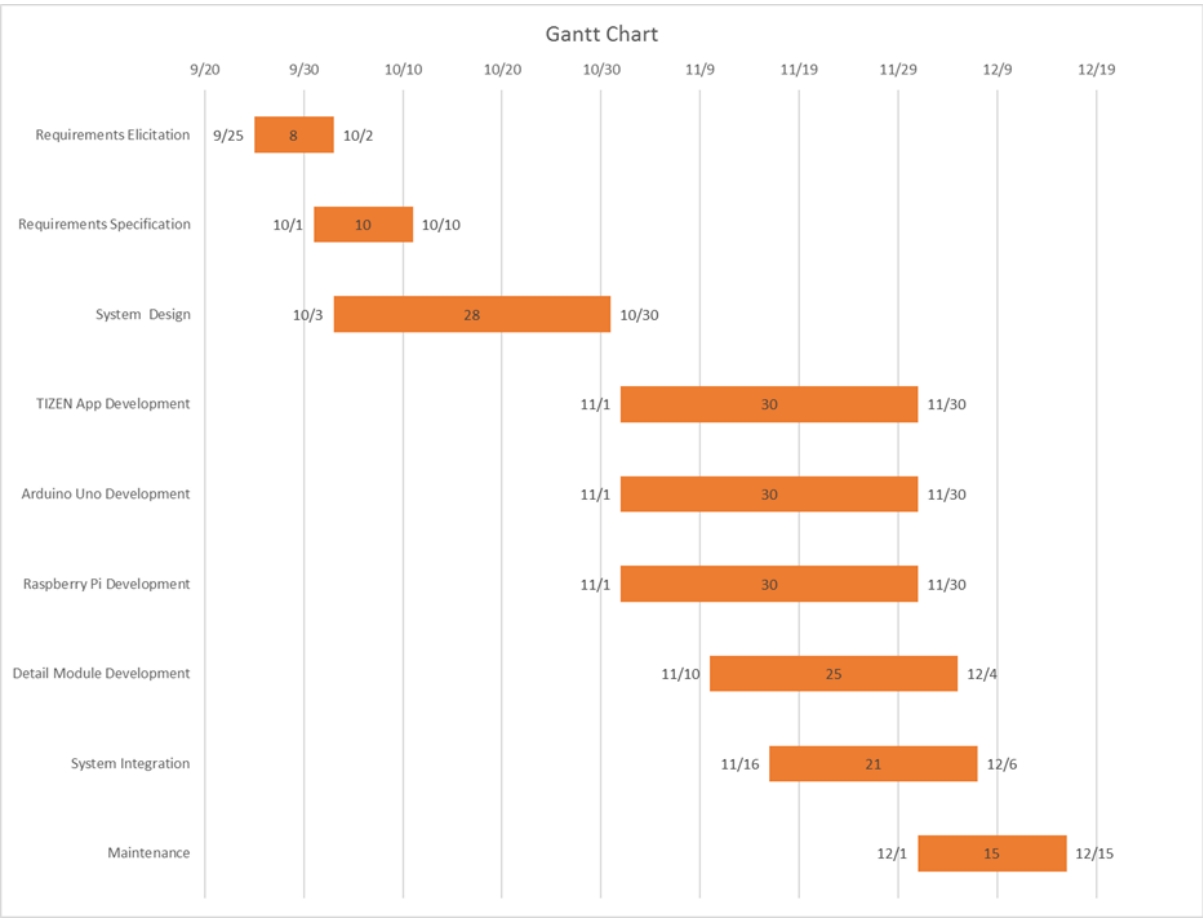The chart below shows the time plan of out project to build SHGS.

Figure 21. Gantt chart of our progress

We divided the work into respective task by using Work Breakdown Structure based on Gantt chart.

Step	Specific Task	performer	9		10				11				12			
			3	4	1	2	3	4	1	2	3	4	1	2	3	4
Anlalysis	Idea Derivation	All	■	■												
	Purpose Specification	All		■	■											
Design	Requirement Analysis	All			■	■	■									
	System Achitecture Design	All				■	■									
	Server Design	All					■	■								
	Database Design	All					■	■								
Implementation	TIZEN App Development	Sunghoon							■	■	■					
	Arduino Uno Development	Hyesun							■	■	■					
	Rasperry Pi Development	Byungwook							■	■	■					
	Database Construct	Hyesun							■	■	■					
	Server Construct	Byungwook							■	■	■					
	Server / DB Integration	Sunghoon									■	■				
	System Integration	All										■				
V&V	Testing	All											■			
	Problem Solving	All											■	■		
	Consecutive Maintenance	All													■	■

Figure 22. Work Break Structure of our Project

7. Reference

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