**Software Requirements Specification (SRS)**

Revision History:

|  |  |  |
| --- | --- | --- |
| Date | Author | Description |
| 2019.3.25 | Li Yuanjin | Editing Software Requirements Specification |
| 2019.3.26 | Zhang Yifan | Editing the Detailed Requirements |
| 2019.3.26 | Wang Zhongyu | Editing the Quality Requirements |
| 2019.3.31 | Zhang Yifan | Modify the use cases |
| 2019.3.31 | Li Yuanjin | Modify the use cases |
| 2019.4.1 | Li Yuanjin | Modify the Output |
| 2019.4.1 | Zhang Yifan | Modify the Input |
| 2019.4.1 | Zhang Yifan | Add the Definitions |
| 2019.4.1 | Li Yuanjin | Modify the use cases |
| 2019.5.10 | Li Yuanjin | Second iteration |
| 2019.5.29 | Li Yuanjin | Modify the general use cases graph and use cases(delete priority checking) |
| 2019.5.30 | Li Yuanjin | Add alternate flow of some use case |

**1.  Introduction**

**1.1    Intended Audience and Purpose**

This document is intended to provided information guiding the installation and development process, ensuring that all system requirements are met. The following entities may find the document useful:

Primary Customer - This page will detail all of the application requirements as understood by the production team. The customer should be able to determine that their requirements will be correctly reflected in the final product through the information found on this page.

User - A prospective user will be able to use this document to identify the main functionality included in the application. Furthermore, the application will have a set of system requirements before the application can be run. Details regarding these requirements can be found here.

Development Team - Details of specific requirements that the final software build must include will be located here. Developers can use this document to ensure the software addresses each of these requirements.

QA Team - By developing testing procedures founded in the system requirements, the QA Team can create a comprehensive testing regimen that will guarantee requirements are met.

**1.2    How to use the document**

Table of Contents:  
  
1. Introduction  
2. System Capabilities - broad description of the purpose of the application  
  2.1 System Context - details any specific system requirements the application will require to run  
  2.2 System Capabilities - description in prose of all capabilities available to the user in the address book  
  2.3 Use cases - A detailed look at each functional requirement, describing the application context both before and after an action is taken  
3. Behavioral Requirements - How the application will interact with a user  
  3.1 Input and output requirements - A description of allowed inputs and generated outputs  
    3.1.1 Input - Describes any restrictions that will be placed on allowed input  
    3.1.2 Output - Describes the range of outputs that can be generated  
4. Quality Requirements - Requirements not pertaining to the function of the application will be listed here  
5. Expected Subsets - Expected levels of functionality at checkpoints during development  
6. Fundamental Assumptions - Some specifics about input, output, or behavior upon which other requirements are founded will be listed here  
7. Expected Changes - Future features and directions the project is expected to take  
8. Appendices - Details aiding the understanding of this document  
  8.1 Definitions and acronyms - Any technical terms or abbreviations will be spelled out here for ease of use of the document  
    8.1.1 Definitions - Definitions of technical or unusual terminology  
    8.1.2 Acronyms and Abbreviations - Any abbreviated terms will be expanded here  
  8.2 References - any external references necessary or helpful to understanding this document will be listed here

**2.** **System Capabilities**

This product is a control system for intelligent lighting systems which developed for university classrooms. The system can realize the control of the switch state of the lights in the classroom by analysis according to the information of the light sensor and the infrared sensor sent to the server and the received network request.

**2.1    System Context**

The system needs to be used on the PC side, so the system environment applied is as follows:

Windows:

* Windows 10 (8u51 and above)
* Windows 8.x (Desktop)
* Windows 7 SP1
* Windows Vista SP2
* Windows Server 2008 R2 SP1 (64-bit)
* Windows Server 2012 and 2012 R2 (64-bit)
* RAM: 128 MB
* Disk space: 128 MB
* Processor: Minimum Pentium 2 266 MHz processor

Mac OS X:

* Intel-based Mac running Mac OS X 10.8.3+, 10.9+
* Administrator privileges for installation

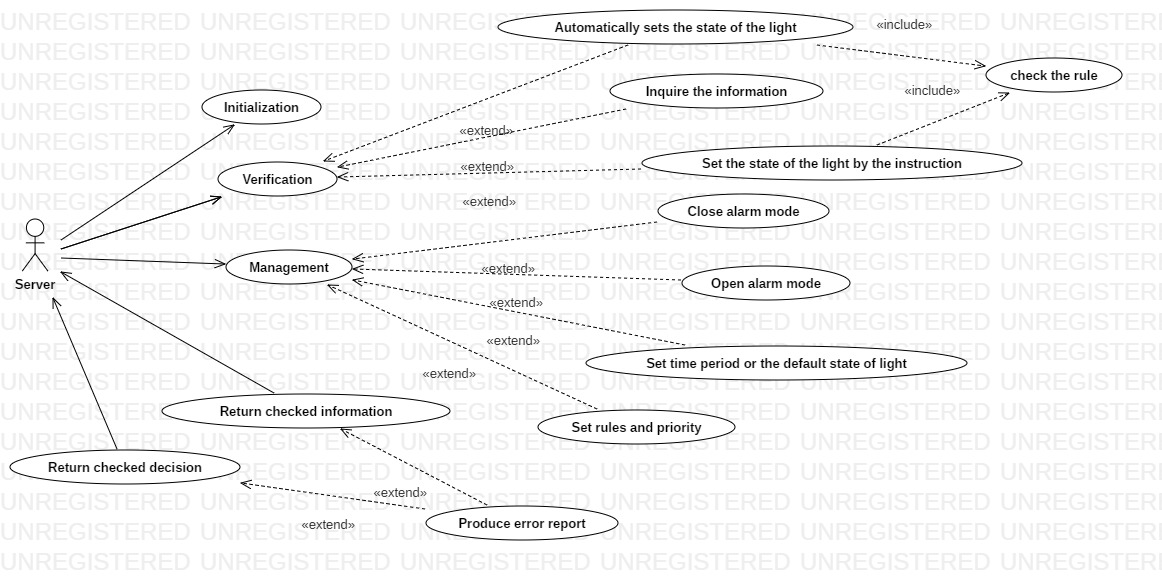
Linux:

* Oracle Linux 5.5+1
* Oracle Linux 6.x (32-bit), 6.x (64-bit)2
* Oracle Linux 7.x (64-bit)2 (8u20 and above)
* Red Hat Enterprise Linux 5.5+1, 6.x (32-bit), 6.x (64-bit)2
* Red Hat Enterprise Linux 7.x (64-bit)2 (8u20 and above)
* Ubuntu Linux 12.04 LTS, 13.x
* Ubuntu Linux 14.x (8u25 and above)
* Ubuntu Linux 15.04 (8u45 and above)
* Ubuntu Linux 15.10 (8u65 and above)

**2.2 System capabilities**

The control system can be divided into two main modes: automatic control mode and human command mode. In the automatic control mode, the system can automatically determine whether it is necessary to change the state of the lamp and execute it by acquiring sensor information. In the human command mode, the system performs different operations according to the authority of the command. When the authority level of the instruction is high, the instruction can be executed, however, when the authority level of the instruction is low, in order to prevent the misoperation behavior, the situation is judged by acquiring the sensor information to intelligently control the light in the room.

**2.3 Use Cases**



**2.3.1 Initialize the system**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Initialize the system | | |
| Version | 2.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement | | |
| Purpose | Initialize the system | | |
| Goals | Make the system start to work | | |
| Summary | Server give a signal and data package to make the system initialized. | | |
| Actors | Server | | |
| Trigger | Customer start the system | | |
| Precondition | None | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package to initialize the system | |  |
| 2 |  | | Initialization and sends a reply to server(If failed, move to alternate flow 2.1) |
| Frequency | Do it when customer want | | |  |
| Type | Primary | | |
| Chart | <<extend>>  Server  Initialization  Produce error report  Return checked information | | |
| Alternate Flow | *Actor* | | System |
| 2.1 |  | | sends an error report to server |

**2.3.2 Automatic control mode**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Automatic control mode | | |
| Version | 3.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement | | |
| Purpose | Power saving intelligently | | |
| Goals | Control the status of the light Automatically | | |
| Summary | Automatically sets the state of the light. | | |
| Actors | Server | | |
| Trigger | None | | |
| Precondition | Automatic control mode | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a heartbeat data package. | |  |
| 2 |  | | IC verifies the situation (if be lack of sensor), checks rules then sends the command back to the server or sends an error report |
| Frequency | When the heartbeat data package comes once 30 minutes | | |  |
| Type | Primary | | |
| Chart  <<extend>>  Server  Produce error report  Return checked decisions  Check rules  <<include>>  Automatically sets the state of the light |  | | |
| Alternate Flow | *Actor* | | System |

**2.3.3 Command-light mode**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Use Case | | Command-light mode | | | | |
| Version | | 3.1 | | Created | *2019-5-10* | |
| Author | | Li Yuanjin | | | | |
| Source | | Requirement | | | | |
| Purpose | | Turn the light on or off correctly by instruction | | | | |
| Goals | | Change the status of the light or give the error report | | | | |
| Summary | | A user issues an instruction to change the light through the server, then the Intelligent Control System (our system) make a judgement and return the result. | | | | |
| Actors | | Server | | | | |
| Trigger | | Someone gives an instruction to change the status of the light. | | | | |
| Precondition | | None | | | | |
| Basic Flow | | *Actor* | | | System | |
| 1 | | Server sends a data package which including instruction to change the state of the light  of the light | | |  | |
| 2 | |  | | | IC verifies the situation (if be lack of sensor), checks rules then sends the command or information back to the server | |
| Frequency | | Do it when server sends a data package | | | | |
| Type | | Primary | | | | |
| Chart  <<extend>>  Server  Produce error report  Return checked information and decisions  Check rules  <<include>>  Set the state of the light by the instruction | |  | | | | |
| Alternate Flow | | *Actor* | | | System | |

**2.3.4 Setting mode**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Setting mode | | |
| Version | 3.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement | | |
| Purpose | (The administrator) Set the time period that during these time slots our system will keep the light on or off all the time, until a teacher’s or administrator’s command change the state. Or set the default state of the light. | | |
| Goals | Set the time period or set the default state of the light. | | |
| Summary | An administrator issues a command to change the time periods or set the default state of the light through the Server, then the Intelligent Control System (our system) make a judgement and return the results or the reason why he can’t do it. (IC should record the new rules) | | |
| Actors | Server | | |
| Trigger | A command to change the time periods | | |
| Precondition | The command must come from an administrator. | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package | |  |
| 2 |  | | Record the rule and send decision to Server |
| Frequency | Do it when server sends a data package | | |
| Type | Primary | | |
| Chart  <<extend>>  Server  Produce error report  Return checked information  Set time period or the default state of light |  | | |
| Alternate Flow | *Actor* | | System |

**2.3.5 Rules setting mode**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Rules setting mode | | |
| Version | 3.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement | | |
| Purpose | (The administrator) Set the rules of our system, including permissions, priorities and the time of instruction coverage and shutdown time of light | | |
| Goals | Set the rules | | |
| Summary | A user issues a command to change the rules through the Server, then the  Intelligent Control System (our system) make a judgement and return the results or the reason why he can’t do it. (IC should record the new rules) | | |
| Actors | Server | | |
| Trigger | A command to set the rules. | | |
| Precondition | The command came from an administrator. | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package | |  |
| 2 |  | | Record the rules and send report to Server |
| Frequency | Do it when server sends a data package | | |
| Type | Primary | | |
| Chart | <<extend>>  Server  Produce error report  Return checked information  Set rules and priority | | |
| Alternate Flow | *Actor* | | System |

**2.3.6 Open the alarm mode**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Open the alarm mode | | |
| Version | 1.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement of the second iteration | | |
| Purpose | Turn on all the lights and sirens in the same building and keep the status until Administrator close the alarm mode | | |
| Goals | IC get the alarm status and refuse the other request and command in this building unless the administrator close the alarm mode. | | |
| Summary | Server sends a data packages (which should be including all ids of lights and sirens), IC record the status. | | |
| Actors | Server | | |
| Trigger | Someone presses the panic button | | |
| Precondition | None | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package | |  |
| 2 |  | | System records the status and sends a reply. |
| Frequency | Do it when server sends a data package | | |  |
| Type | Primary | | |
| Chart  <<extend>>  Server  Produce error report  Return checked information  Open alarm mode |  | | |
| Alternate Flow | *Actor* | | System |

**2.3.7 Close the alarm mode**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Close the alarm mode | | |
| Version | 1.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement of the second iteration | | |
| Purpose | Close the alarm mode and turn in to the normal situation. | | |
| Goals | Turn off all the siren in this building, record the time, turn off all the sirens and can receive the request from all user from now. | | |
| Summary | Server sends a data package (which should be including all ids of lights and sirens) to IC, IC record the time, turn off all the sirens and can receive the request from all user from now. | | |
| Actors | Server | | |
| Trigger | Administrator turn off the alarm | | |
| Precondition | None | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package | |  |
| 2 |  | | System record the time, turns off all the sirens and can receive the request from all user from now and send a reply to server. |
| Frequency | Do it when server sends a data package | | |  |
| Type | Primary | | |
| Chart  <<extend>>  Server  Produce error report  Return checked information  Close alarm mode |  | | |
| Alternate Flow | *Actor* | | System |

**2.3.8 Inquire the information**

|  |  |  |  |
| --- | --- | --- | --- |
| Use Case | Inquire the information | | |
| Version | 1.1 | Created | *2019-5-10* |
| Author | Li Yuanjin | | |
| Source | Requirement of the second iteration | | |
| Purpose | Administrator inquire the information of the system | | |
| Goals | Return the information or error report to server | | |
| Summary | Server sends a inquire package. By checking the permission, IC send the needed information or error report to server. | | |
| Actors | Server | | |
| Trigger | Administrator inquire the information of the alarm or panic button and so on | | |
| Precondition | None | | |
| Basic Flow | *Actor* | | System |
| 1 | Server sends a data package | |  |
| 2 |  | | System send the needed information or error report to server. |
| Frequency | Do it when server sends a data package | | |  |
| Type | Primary | | |
| Chart  <<extend>>  Server  Produce error report  Return checked information  Inquire the information |  | | |
| Alternate Flow | *Actor* | | System |

**3.    Detailed Requirements**

**3.1 System Inputs and Outputs**

This system will automatically ask for data about the sensors and lights from the Server in cycles.

And when a instruction arrives at the Server, it will sends data to our system, including the state of the light, the the relevant sensors’ data, the user’s information and the instruction.  
The sensors now have three kinds, which are the motion sensor, light senor and button sensor.

**3.1.1 Inputs**

(1)ROOM{

\*Room\_id: the id of the room

\*Light state{

\*State: it can be a boolean type, whose value is true or false. True means that it is on now, while false means the opposite.

...

}

\*Sensor state{

\*kind: it is a string type, has three values, {motion, light, button, panic button}

\*online: it is a boolean type.

\*value: It is a numerical type.

}

};

(2)Instruction{

\*User\_priority: it is a numerical type and means user’s priority

\*Instruction\_type: the instruction has four kinds, { auto, instruction, time, rules}.

\*Extra\_information: set time period or make rules.

};

(3)Extra\_information{

\*Data\_about\_time: .....

\*Data\_about\_rule: ......

\*Data\_about\_priority: ......

} ;

**3.1.2 Outputs**

This system will send its output to the Server.

\*Result: There outputs required, there are {value, room, hint}.

{

\*value: it is a string type whose value is in set:{“open”, “close”, “null”, “exception”} . “open” means turn on the light, “close” means turn off the light, “null” means do nothing and “exception” means don’t change the light and send some error information to the Server.

\*room: it is a numerical type that means the result for which room.

\*hint: it is a string type, the content is for explaining the result when intelligent control system reject the command.

}

**4   Quality Requirements (Non-functional Requirements)**

**Behavioral (run-time) qualities:**

* Performance

the elapsed time between the IC receive the command from server and the IC

system’s response must be <= 100 ms

* Security

No body can change the rule except administrator

* Reliability

The IC can ignore those commands illegal or too often such as

1. Students want to turn on the light when there is nobody in the room.
2. Students want to turn on the light when the light is enough.
3. IC received more than one command during 1 second.
4. IC received the student’s command after teacher’s command one minute later.(the IC must set how long does each command can effect or shield other commands)

* Availability

If receives an illegal command, IC should return the error information to the server such as :

1. Condition error: students want to turn off the light but somebody is in the room.(there is confliction between students’ commands and sensors’ information)
2. Authority error: students want to turn off the light during the specific time set by administrator.

**Developmental (design-time) qualities:**

* Modifiability
* Maintainability
* Portability
* Reusability
* Understandability

**5. Expected Subsets**

The core of this intelligent control system is to be able to analyze the priority of turning on/off the light according to the authority and sensor status.

**6.    Fundamental Assumptions**

The application can run on any system.

Developing Software: not sure.

Developing Environment: Raspberry Pi

**7.    Expected Changes**

7.1.We expect that the system can be expended to serve for multiple rooms and multiple lights. We can group rooms and light to fit our needs in different situation.

**8.    Appendices**

**8.1    Definitions and acronyms**

**8.1.1    Definitions**

|  |  |
| --- | --- |
| **Keyword** | **Definitions** |
| \*Sensor state | The structure contains attributes that all sensors have. |
| \*online | Boolean type, true means the sensor is online, false means offline |
| \*value | Its meaning changes over different sensor. For motion sensor, if there are someone in the room, the value will be larger than zero. And for the “light sensor”, the brighter the room, the lager the value will be. Finally, for the “button sensor”, if the user wants to change the light’s state, the value will be larger than zero |
| \*User\_priority | The smaller the number is, the low-level permissions the user has. Now settings are that students have level-1, buttons have level-2 and teachers & Administrators both have level-3. |
| \*Data\_about\_time | Some information about the instruction that plans to set the time period |
| \*Data\_about\_rule | Some information about the instruction that plans to set the rules. |
| \*Data\_about\_priority | Some information about the instruction that plans to set the priority |

**8.1.2    Acronyms and abbreviations**

|  |  |
| --- | --- |
| **Acronym or**  **Abbreviation** | **Definitions** |
| IC | Intelligent Controller |
|  |  |
|  |  |

**8.2    References**