# REQUIREMENTS SPECIFICATION

# for

# BLC's Automated Light Guide

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# Contents



## Revision History

| Name | Date | Reason for Changes | Version |
|---|---|---|---|
| Magnus Tang, Emil Hu, Daniel Biørrith, Jens Fisker, Bastian Kramer | 17/02/2021 | Initializing the document and first though about the use cases. | 01 |
| Magnus Tang, Emil Hu, Daniel Biørrith, Jens Fisker, Bastian Kramer | 03/03/2021 | Updating the use case diagram, and with it the corresponding use cases. | 02 |
| Magnus Tang, Emil Hu, Daniel Biørrith, Jens Fisker, Bastian Kramer | 23/03/2021 | More formal text and updating the use case diagram and use case descriptions. | 03 |
| Magnus Tang, Emil Hu, Daniel Biørrith, Jens Fisker, Bastian Kramer | 10/04/2021 | Updating use case extensions and use case diagram. Inserting actor descriptions. | 04 |

# 1 Introduction

The purpose of this report is to present a requirement specification for Blinding Lights Corporation (BLC). This requirements specification is developed from the project description provided by the costumer and therefore acts as a contract between the developers and the customer of what is to be developed during the project. Thus, all changes to this document are approved on a common meeting.

This document will cover the functional requirements, which will be showcased in the form of use cases. Thus, a use case diagram has been drawn, and the use cases have been derived therefrom and have been further elaborated by fully dressed use cases. The document also includes a set of nonfunctional requirements derived from the project description.

# 2 Overall Project Description

The project is an automated light guide, which is designed to interactively guide elderly people, who frequently leave bed at night, from the bedroom through their residence and to the restroom and back to the bedroom.
The product will not only guide the user to the bathroom, but also provide a database with information of the frequency and duration of the their trips from the bed to the restroom.

# 3 System Requirements

This section will present the system requirements of the project. First a use case diagram for system will be presented followed by a overview of all the use cases. Lastly, the full use case descriptions will be described as well as the non-functional requirements of the project.

## 3.1 Use Case Diagram

Figure 3.1 shows the general system in the form of an use case diagram for BLC's automated light guide. The purpose of the diagram is to give an overview of the system functionality and showcase how each actor of the system interact with each other.

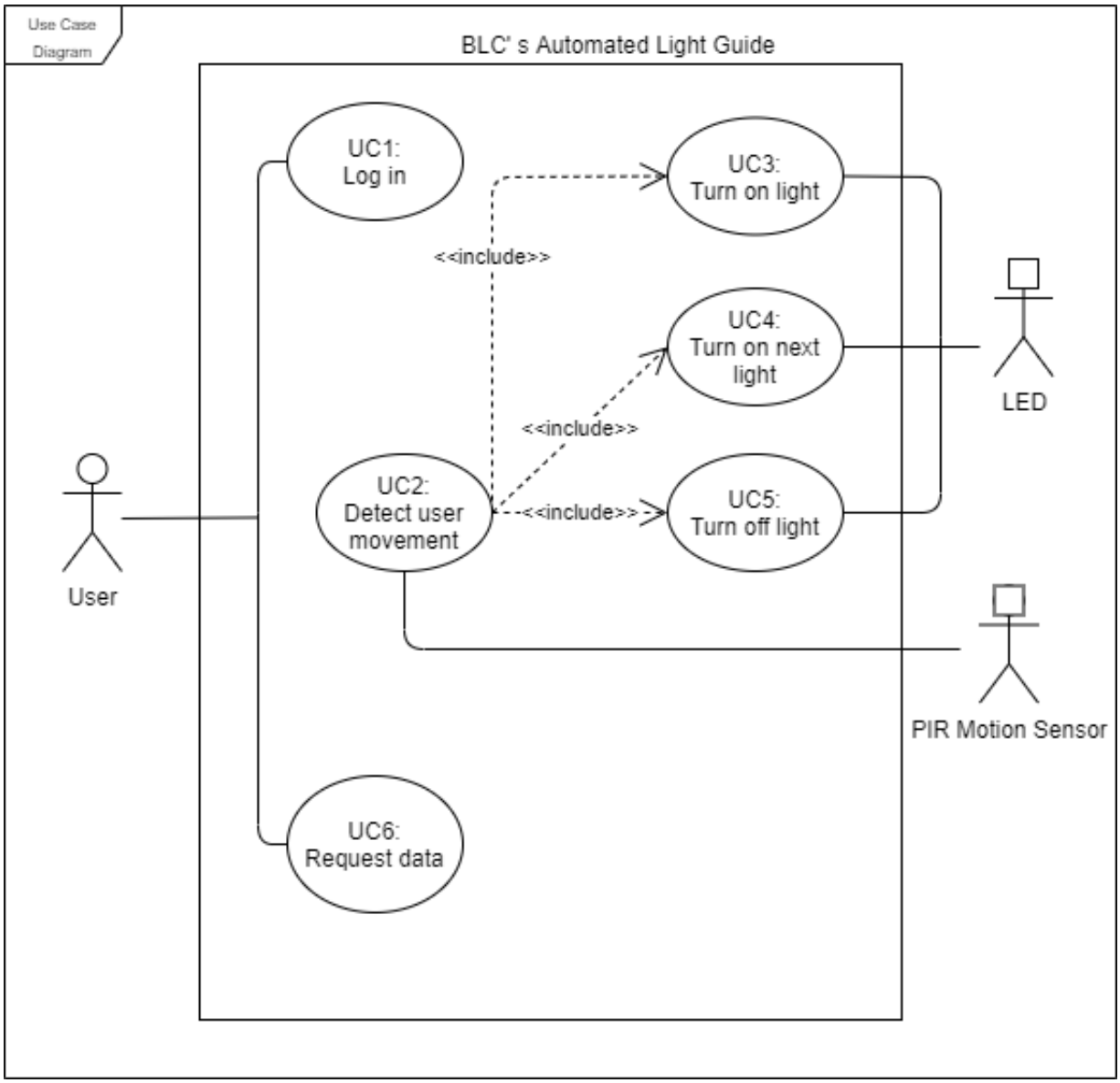


Figure 3.1: UML Use Case Diagram

### 3.1.1 Actor description

As stated, the system consists of user, a light emitting diode (LED) and a passive infrared (PIR) motion sensor.

The following tables will give a short description of each actor.

| **Actor** | User |
|---|---|
| **Type** | Primary actor |
| **Description** | The patient is the actor, which shall use BLC's automated light guide. The user is someone who wants to access data from our system |

Table 3.1: Actor description for the patient

| **Actor** | LED |
|---|---|
| **Type** | Secondary actor |
| **Description** | The LED is the unit that shall turn on the lights in case of user movement. |

Table 3.2: Actor description for the LED

| **Actor** | PIR motion sensor |
|---|---|
| **Type** | Secondary actor |
| **Description** | The PIR motion sensor shall detect movement from the user |

Table 3.3: Actor description for the PIR motion ssensor

### 3.1.2 Use Case Overview

A descriptive overview of the use cases represented in figure 3.1 is shown in the table below

| **ID** | **Name** | **Description** |
|---|---|---|
| UC1 | Log in | The user shall be able to log in to the application. |
| UC2 | Detect user movement | When the user moves, the motion sensor shall detect this movement. |
| UC3 | Turn on light | The LED shall turn on the lights inside the room, when the motion sensor has detected movement in the room |
| UC4 | Turn on next light | The LED of the next presumed room on the way to the bathroom shall turn on its lights, when the motion sensor has detected movement in the previous room. |
| UC5 | Turn off light | The LED shall turn off the lights in the room if the motion sensor does not detect movement in the room. |
| UC6 | Request stored data | The user shall be able to get the logged data from the sensors and LED from the application. |

Table 3.4: Use Case Overview

## 3.2 Use Cases

The following subsections present the full description of each use case.

### 3.2.1 Log in

| Name | Log in |
|---|---|
| Use Case | UC1 |
| Primary Actor | User |
| Precondition | The user has an username and password |
| Postcondition | The user enters the web application |
| Main Scenario | 1. User enters correct username and password<br>2. User enters the application |
| Extensions | **Extension 1.1: 1-2**:<br>1. User enters either wrong username or wrong password<br>2. System responds with an error message |

### 3.2.2 Detect User Movement

| Name | Detect user movement |
|---|---|
| Use Case | UC2 |
| Primary Actor | User & Motion sensor |
| Precondition | A motion sensor is installed in the room |
| Postcondition | The motion sensor detects movement inside the room and the data from the motion sensor is sent to the webserver. |
| Main Scenario | 1. User moves inside the room<br>2. Motion sensor registers movement from the user<br>3. Motion sensor sends data<br>4. The data from the motion sensor is logged in the webserver |
| Extensions | **Extension 2.1: 2-4**:<br>2. Motion sensor does not work or is turned off<br>3. No data is sent<br>4. No data is sent to the webserver<br>**Extension 2.2: 4**:<br>4. Webserver is down |

### 3.2.3 Turn On Light

| Name | Turn on light |
|---|---|
| Use Case | UC3 |
| Primary Actor | LED & Motion sensor |
| Precondition | UC2 & A LED is installed in the room |
| Postcondition | LED strip in the room turns on |
| Main Scenario | 1. LED receives signal<br>2. LED turns on inside the room |
| Extensions | **Extension 3.1: 1-2**:<br>1. LED does not receive a signal<br>2. LED does not turn on<br>**Extension 3.2: 1-2**:<br>1. LED malfunctions or is turned off<br>2. LED does not turn on |

### 3.2.4 Turn On Next Light

| Name | Turn on next light |
|---|---|
| Use Case | UC4 |
| Primary Actor | LED & Motion sensor |
| Precondition | UC2 & A motion sensor and a LED are installed in the given room |
| Postcondition | The LED strip in the next room turns on |
| Main Scenario | 1. LED in the first room turns on<br>2. LED in the next room receives signal to turn on<br>3. LED turns on in the given room |
| Extensions | **Extension 4.1: 1-3**:<br>1. LED in the former room does not turn on<br>2. LED receives a signal<br>3. LED turns on in the room<br>**Extension 4.2: 1-3**:<br>1. LED in the former room does not turn on<br>2. LED does not receive a signal<br>3. LED does not turn on in the room<br>**Extension 4.3: 2-3**:<br>2. LED in the next room malfunctions or is turned off<br>3. LED does not turn on<br>**Extension 4.4: 2-3** :<br>2. LED in the wrong room receives signal to turn on<br>3. LED in the wrong room turns on |

### 3.2.5 Turn Off Light

| Name | Turn off light |
|---|---|
| Use Case | UC5 |
| Primary Actor | LED & Motion sensor |
| Precondition | No movement detected |
| Postcondition | The LED of the room, that has been left by the user, turns off |
| Main Scenario | 1. LED receives signal to turn off<br>2. LED turns off. |
| Extensions | **Extension 5.1: 2-3**:<br>2. LED does not receive a signal to turn off<br>3. LED stays on |

### 3.2.6 Request Stored Data

| Name | Request data |
|---|---|
| Use Case | UC6 |
| Primary Actor | User |
| Precondition | UC1 |
| Postcondition | User gets the requested data that has been stored |
| Main Scenario | 1. User requests data<br>2. User gets the data |
| Extensions | **Extension 6.1: 1-2**:<br>1. The request is denied<br>2. The user does not get the data<br>**Extension 6.2: 2**:<br>2. Data for a different user is returned |

## 3.3 Nonfunctional Requirements

Besides these functional requirements, our system also consists of the following nonfunctional requirements:

NR1. The system shall support a minimum of 5 areas in the given residence.

NR2. The system must support Message Queuing Telemetry Transport (MQTT) [1] with JavaScript Object Notation (JSON) [2] encoding for the server communication as well as the Healthcare Equipment Usage and Context Data (HEUCOD) [3] recommendations.

NR3. The system shall use Zigbee [4] based sensors and actuators and a Raspberry Pi 4 [5] as the controller.

NR4. PIR sensors will be used to detect user presence and LEDs to turn on the lights.

NR5. The system must provide a web application for the user.

NR6. The system will use a MySQL database [6] and the server will be based on NodeJS, which is a back-end JavaScript runtime environment [7].

# References


[1] Andrew Banks, Ed Briggs, Ken Borgendale, Rahul Gupta, "MQTT," accessed 23 March 2021. [Online]. Available: https://mqtt.org/

[2] JavaScript, "JSON," accessed 23 March 2021. [Online]. Available: https://www.json.org/json-en.html

[3] Stefan R. Wagner, "Healthcare Equipment Usage and Context Data (HEUCOD) Smart Industry Project," accessed 23 March 2021. [Online]. Available: https://pure.au.dk/portal/en/projects/healthcare-equipment-usage-and-context-data-heucod-smart-industry-project(d4eb9b4b-8070-4bd3-9773-ef4bc8938ce0).html

[4] Zigbee Alliance, "Hvad er Zigbee?" accessed 23 March 2021. [Online]. Available: https://zigbeealliance.org/da/opl%C3%B8sning/Zigbee/

[5] The Raspberry Pi Foundation, "Raspberry Pi 4," accessed 23 March 2021. [Online]. Available: https://www.raspberrypi.org/products/raspberry-pi-4-model-b/

[6] MySQL AB, "MySQL," accessed 23 March 2021. [Online]. Available: https://www.mysql.com/

[7] OpenJS Foundation, "About Node.js," accessed 23 March 2021. [Online]. Available: https://nodejs.org/en/about/