
REQUIREMENTS SPECIFICATION

for

BLC's Automated Light Guide

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Revision History

Name	Date	Reason for Changes	Version
Magnus Tang, Emil Hu, Daniel Biørreth, Jens Fisker, Bastian Kramer	17/02/2021	Initializing the document and first though about the use cases.	01
Magnus Tang, Emil Hu, Daniel Biørreth, 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 Biørreth, 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 Biørreth, 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's (BLC) automated light guide. 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 website 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 an 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.

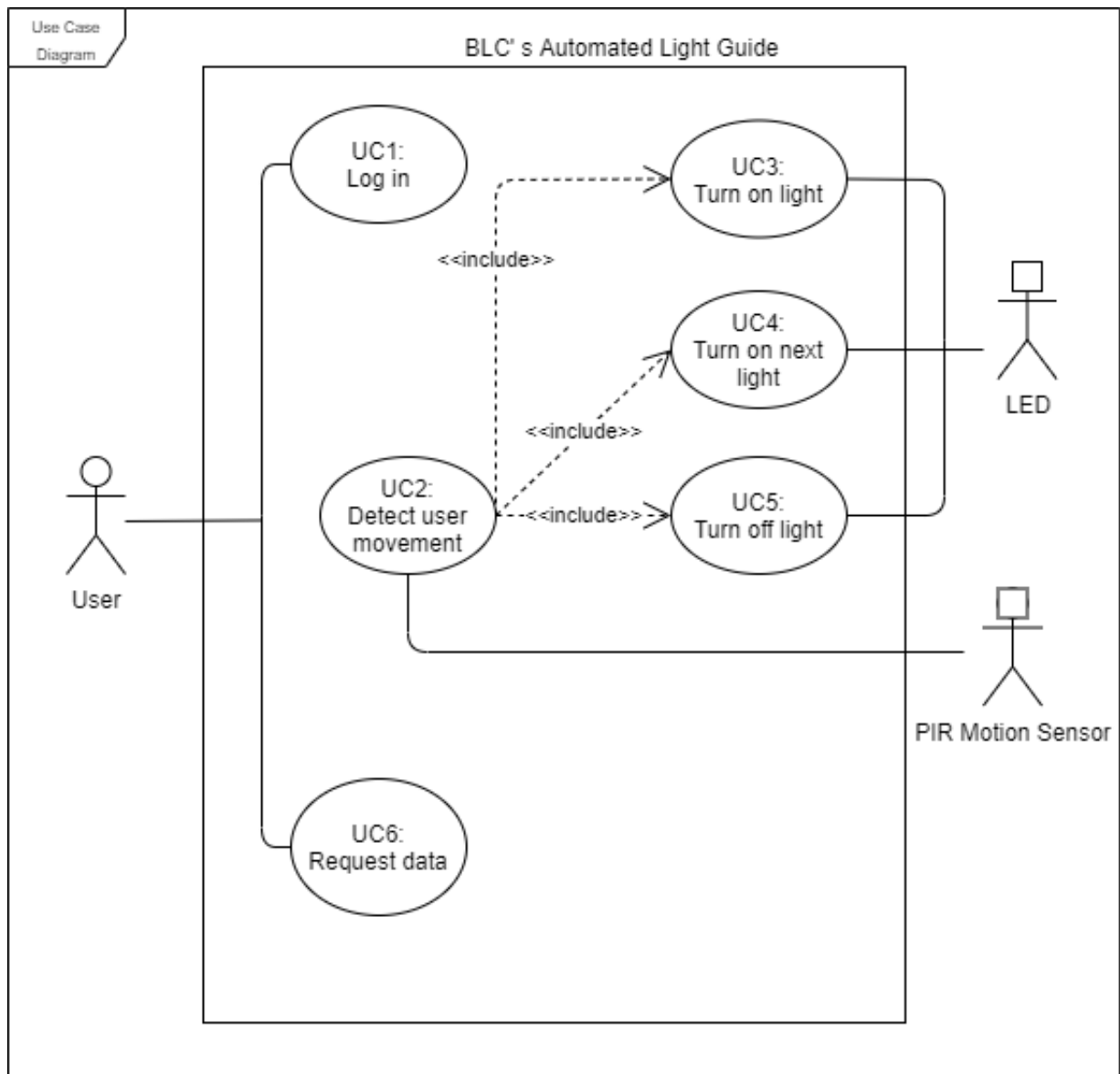


Figure 3.1: UML Use Case Diagram

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, or from, 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 and has access to their data
Main Scenario	<ol style="list-style-type: none">1. User enters correct username and password2. User enters the application
Extensions	Extension 1.1: 1-2: <ol style="list-style-type: none">1. User enters either wrong username or wrong password2. 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	<ol style="list-style-type: none">1. User moves inside the room2. Motion sensor registers movement from the user3. Motion sensor sends data to the controller4. The data from the motion sensor is logged in the webserver.
Extensions	Extension 2.1: 2-4: <ol style="list-style-type: none">2. Motion sensor does not work or is turned off3. No data is sent4. No data is sent to the webserver Extension 2.2: 4: <ol style="list-style-type: none">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	<ol style="list-style-type: none"> 1. LED receives signal 2. LED turns on inside the room
Extensions	<p>Extension 3.1: 1-2:</p> <ol style="list-style-type: none"> 1. LED does not receive a signal 2. LED does not turn on <p>Extension 3.2: 1-2:</p> <ol style="list-style-type: none"> 1. LED malfunctions or is turned off 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	<ol style="list-style-type: none"> 1. LED in the first room turns on 2. LED in the next room receives signal to turn on 3. LED turns on in the given room
Extensions	<p>Extension 4.1: 1-3:</p> <ol style="list-style-type: none"> 1. LED in the former room does not turn on 2. LED receives a signal 3. LED turns on in the room <p>Extension 4.2: 1-3:</p> <ol style="list-style-type: none"> 1. LED in the former room does not turn on 2. LED does not receive a signal 3. LED does not turn on in the room <p>Extension 4.3: 2-3:</p> <ol style="list-style-type: none"> 2. LED in the next room malfunctions or is turned off 3. LED does not turn on <p>Extension 4.4: 2-3 :</p> <ol style="list-style-type: none"> 2. LED in the wrong room receives signal to turn on 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	<ol style="list-style-type: none">1. LED receives signal to turn off2. LED turns off.
Extensions	Extension 5.1: 2-3: <ol style="list-style-type: none">2. LED does not receive a signal to turn off3. 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	<ol style="list-style-type: none">1. User requests data2. User gets the data
Extensions	Extension 6.1: 1-2: <ol style="list-style-type: none">1. The request is denied2. The user does not get the data Extension 6.2: 2: <ol style="list-style-type: none">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 My Structured Query Language (MySQL) database [6] and the server will be based on NodeJS, which is a back-end JavaScript runtime environment [7].

References

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- [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](https://pure.au.dk/portal/en/projects/healthcare-equipment-usage-and-context-data-heucod-smart-industry-project(d4eb9b4b-8070-4bd3-9773-ef4bc8938ce0).html)
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- [5] The Raspberry Pi Foundation, “Raspberry Pi 4,” accessed 23 March 2021. [Online]. Available: <https://www.raspberrypi.org/products/raspberry-pi-4-model-b/>
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- [7] OpenJS Foundation, “About Node.js,” accessed 23 March 2021. [Online]. Available: <https://nodejs.org/en/about/>