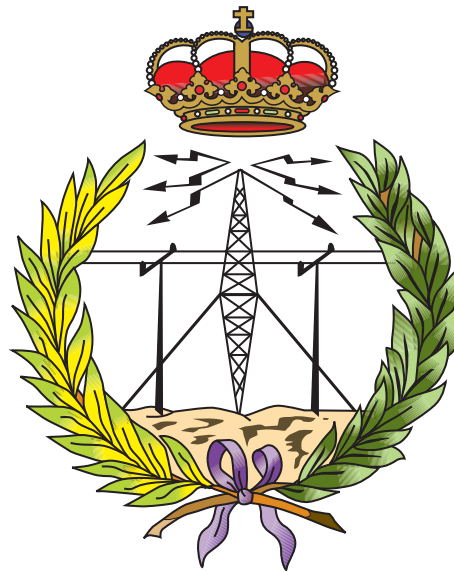


TECHNICAL UNIVERSITY OF MADRID  
SCHOOL OF TELECOMMUNICATIONS SYSTEMS AND ENGINEERING

Semester Project



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Smart Lighting

UBIQUITOUS AND SECURE NETWORKS AND SERVICES

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# Contents

<b>1</b>	<b>Introduction and Executive Summary</b>	<b>2</b>
<b>2</b>	<b>Scheduling of workload</b>	<b>3</b>
<b>3</b>	<b>Requirement Analysis</b>	<b>4</b>
3.1	General use . . . . .	4
3.2	Receive Periodic Data . . . . .	5
3.3	Request data . . . . .	6
3.4	Change parameters . . . . .	7
<b>4</b>	<b>Project Design</b>	<b>8</b>
4.1	UML Component Diagrams . . . . .	8
4.2	UML Class Diagrams . . . . .	9
4.3	Sequence Diagrams . . . . .	12

# 1. Introduction and Executive Summary

## 2. Scheduling of workload

# 3. Requirement Analysis

## 3.1 General use

Figure 3.1: General use

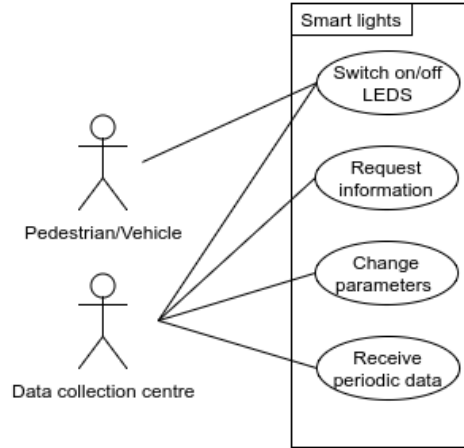


Table 3.1: General use

Scope and Objectives	The lights on the lampposts switch on/off depending on the information of the movement and light sensor of the nodes (if the light is low and the movement sensor detects something, the lights turn on, otherwise they turn off). The data collection centre receives periodically this data and it is capable to change some parameters or request some information of the nodes.
Actors	<ul style="list-style-type: none"> <li>• Pedestrians/vehicles</li> <li>• Data control department of the city</li> </ul>
Preconditions	<ul style="list-style-type: none"> <li>• The sensor nodes are on</li> <li>• A pedestrian/vehicle comes/goes away from the node</li> </ul>
Post-conditions	<ul style="list-style-type: none"> <li>• The lights will turn on/off</li> <li>• All the measured information will be sent to the city data manager</li> </ul>
Sequence Description	<ol style="list-style-type: none"> <li>1. Obtain measurements of movement, temperature, humidity and light.</li> <li>2. If there is a change in the movement sensor and the light measured is low, toggle the lights on the node.</li> <li>3. Send the status of light to the data control department of the city.</li> </ol>
Exceptions	The node is not able to communicate with the data control department of the city.

## 3.2 Receive Periodic Data

Figure 3.2: Receive Periodic Data

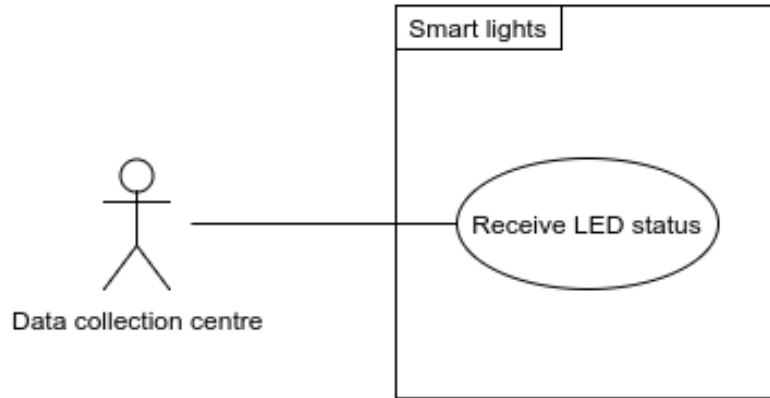


Table 3.2: Receive Periodic Data

Scope and Objectives	The nodes are placed in the lampposts of the street getting information of the movement and the light. This information added to the LED status of the lamppost is sent to the data collection centre periodically.
Actors	Data control department of the city
Preconditions	<ul style="list-style-type: none"> <li>• The sensor nodes are on</li> <li>• The sensor nodes have sufficient memory to store measured values when connection is off</li> </ul>
Post-conditions	<ul style="list-style-type: none"> <li>• The measured value is stored in memory</li> <li>• The measured value is sent to the data control department of the city</li> </ul>
Sequence Description	<ol style="list-style-type: none"> <li>1. Obtain measurement</li> <li>2. Check the network</li> <li>3. If network not available store data</li> <li>4. Send all data to the data control department of the city</li> </ol>
Exceptions	In case of error, report to the data control department of the city

### 3.3 Request data

Figure 3.3: Request Data

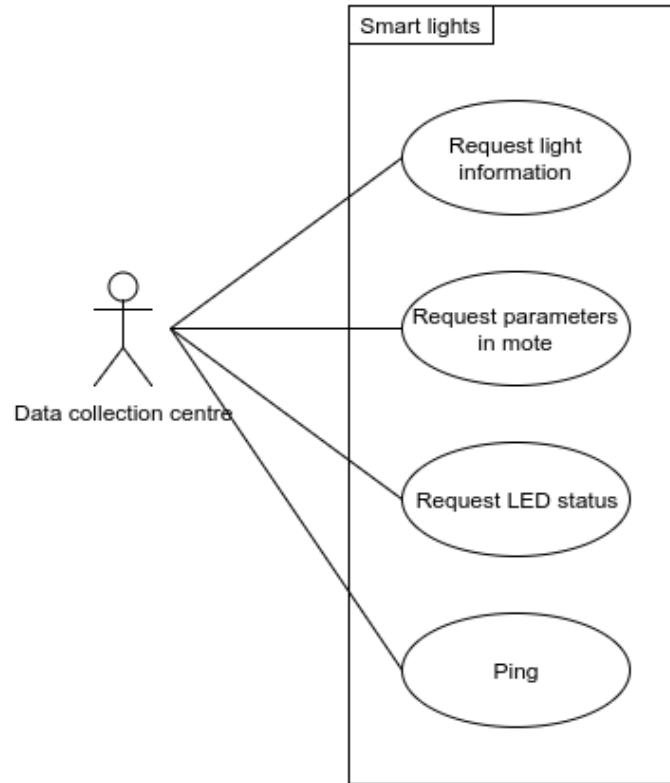


Table 3.3: Request Data

Scope and Objectives	The data collection centre have the possibility to request the information of the light and LED status of the motes and also the parameters that are using the motes. Furthermore, a ping functionality exists to check if the mote is alive.
Actors	Data control department of the city
Preconditions	<ul style="list-style-type: none"> <li>• The sensor nodes are on</li> <li>• The sensor node is online to get the request</li> </ul>
Post-conditions	The measured value and statuses are sent to the data control department of the city
Sequence Description	<ol style="list-style-type: none"> <li>1. Check if node is online</li> <li>2. If not then repeat x times</li> <li>3. Request current data from node</li> </ol>
Exceptions	The sensor node does not respond after x requests

### 3.4 Change parameters

Figure 3.4: Change parameters

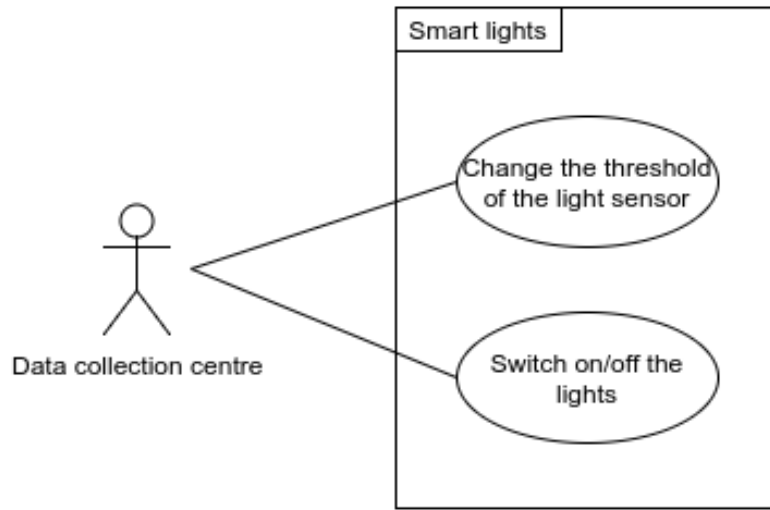


Table 3.4: Change parameters

Scope and Objectives	The data collection center is able to change the threshold of the light sensor and also has the possibility of switch on/off the lights in case of emergency.
Actors	Data control department of the city
Preconditions	<ul style="list-style-type: none"> <li>• The sensor nodes are on</li> <li>• The sensor node is online to get the request</li> <li>• Led light is working</li> </ul>
Post-conditions	<ul style="list-style-type: none"> <li>• The light is turned on/off</li> <li>• Parameters are modified</li> <li>• The status is sent to the data control department of the city</li> </ul>
Sequence Description	<ol style="list-style-type: none"> <li>1. Check if node is online</li> <li>2. If not then repeat x times</li> <li>3. Request switching on/off the light or change of parameters</li> <li>4. Send ack when light turns on or parameters are changed</li> </ol>
Exceptions	<ul style="list-style-type: none"> <li>• The sensor node does not respond after x requests</li> <li>• The light does not turn on/off</li> </ul>



# 4. Project Design

## 4.1 UML Component Diagrams

Figure 4.1: Movement sensor

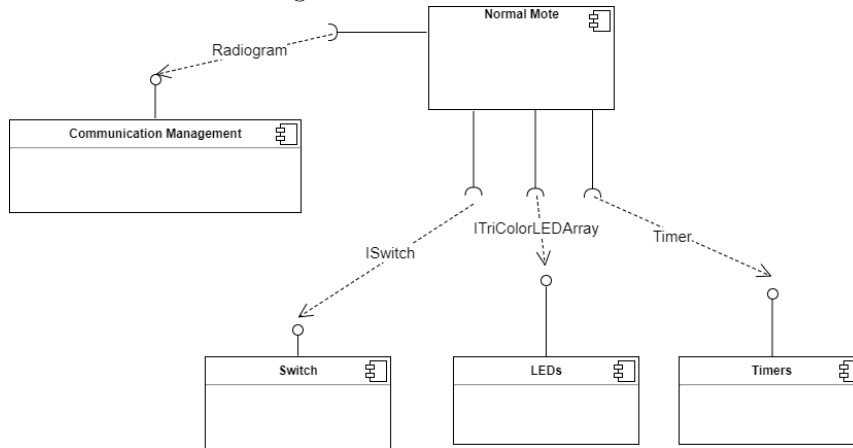


Figure 4.2: Light sensor

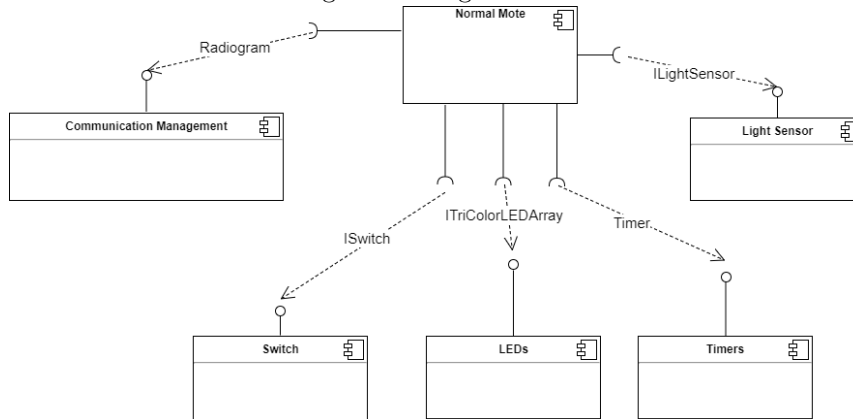


Figure 4.3: Data collection centre

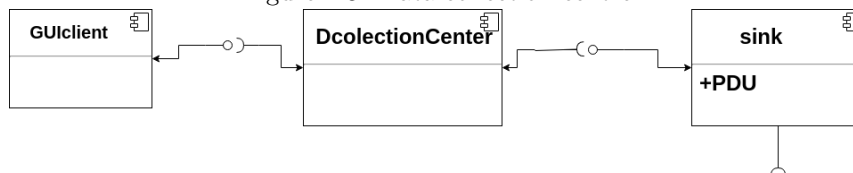
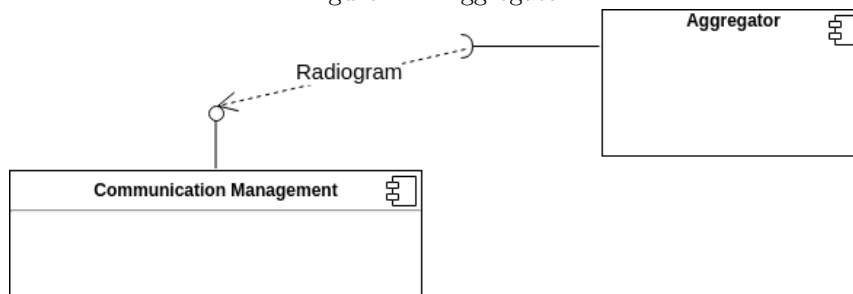


Figure 4.4: Aggregator



## 4.2 UML Class Diagrams

Figure 4.5: Movement sensor

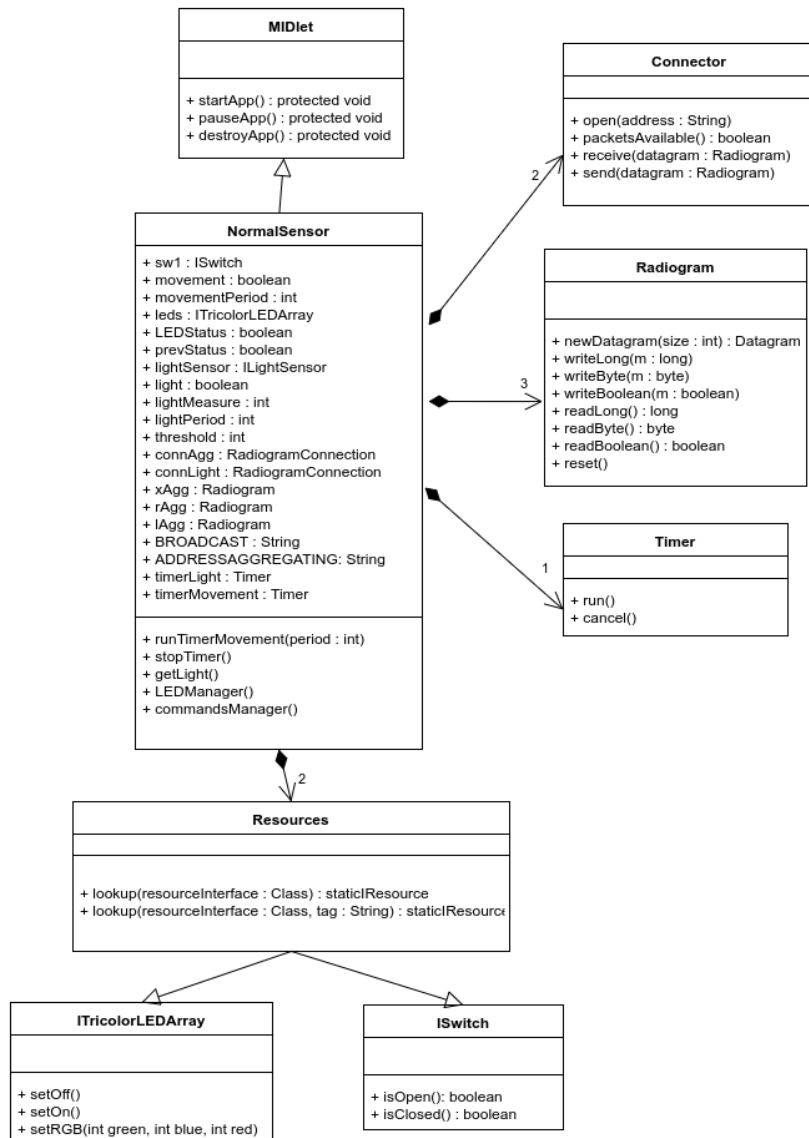


Figure 4.6: Light sensor

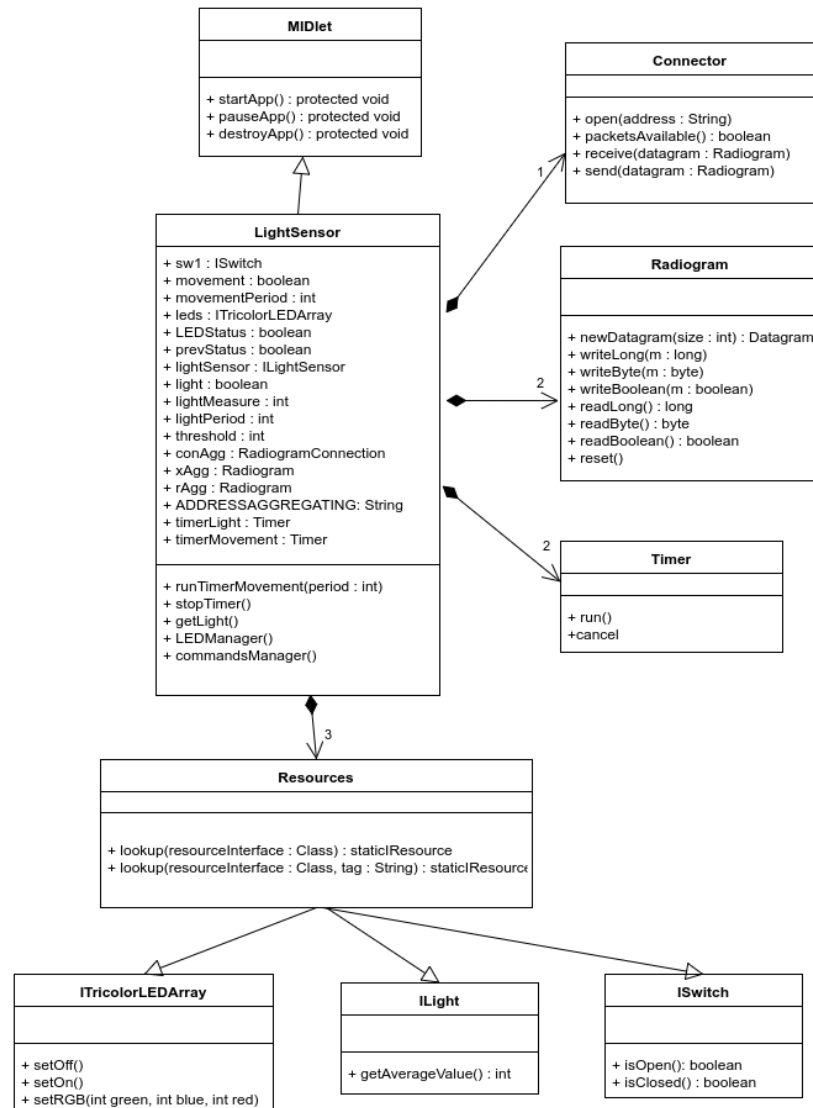


Figure 4.7: Sink

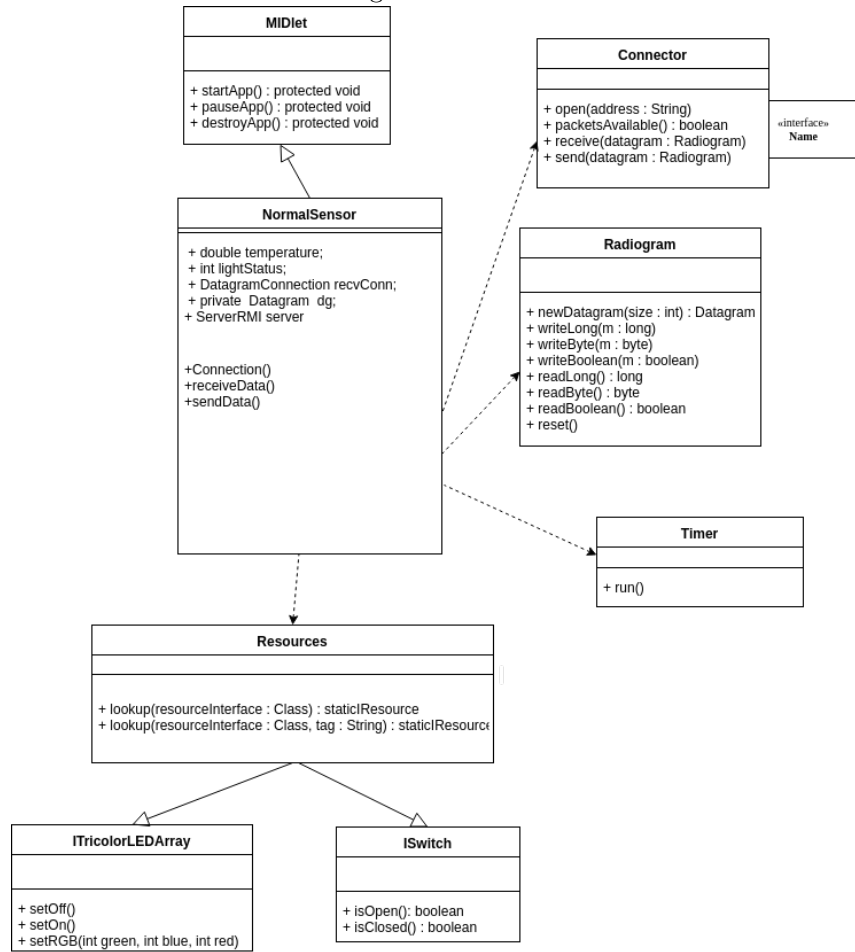
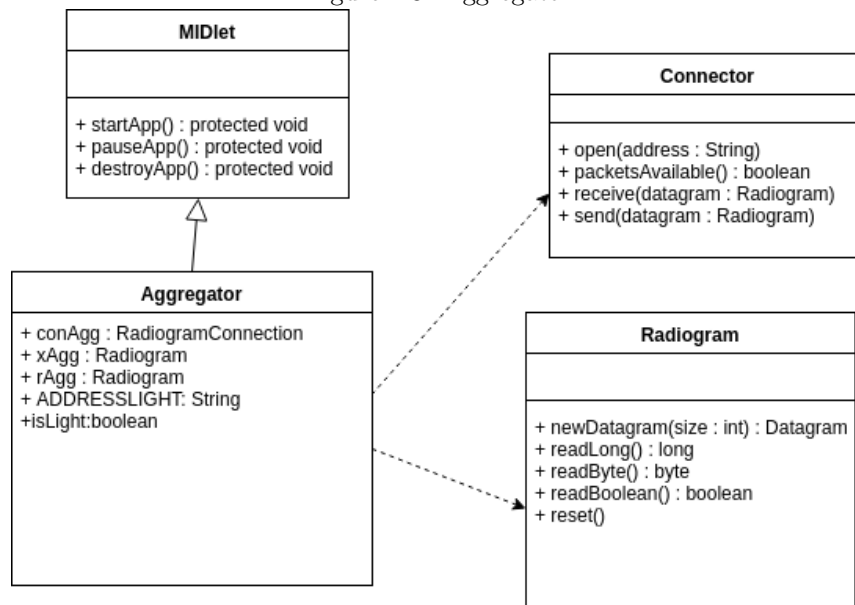


Figure 4.8: Aggregator



### 4.3 Sequence Diagrams

Figure 4.9: Light Broadcast

