



**Politecnico di Milano**

**Department of Computer Science and  
Engineering**

**Software Engineering 2**

**CLup – Customers Line-up  
Requirements Analysis  
and  
Specification Document**

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# Chapter 1

## Introduction

### 1.1 Purpose

#### 1.1.1 Description of the Given Problem

#### 1.1.2 Goals

Bla bla bla...

Goals:

- [G1]: Keep customers in safe condition w.r.t the "*decreto del Presidente del Consiglio dei ministri*" (d.P.C.m) in force inside the store.
- [G2]: Allow customers to line up from a remote device.
- [G3]: Allow store manager to monitor entrances.
- [G4]: Provide estimation of the waiting time.
- [G5]: Notify customers that their turn is coming.
- [G6]: Allow customers to line up from a physical spot.
- [G7]: Allow customers to book a visit from a remote device.
- [G8]: Infer customers visits duration.

### 1.2 Scope

### 1.3 Definitions, Acronyms, Abbreviations

### 1.4 Revision History

### 1.5 Reference Documents

### 1.6 Documents Structure

# Chapter 2

## Overall Description

- 2.1 Product Perspective**
- 2.2 Product Functions**
- 2.3 User Characteristics**
- 2.4 Assumptions, Dependencies and Constraints**

In the scenario we are taking into consideration, we assume the following domain assumptions:

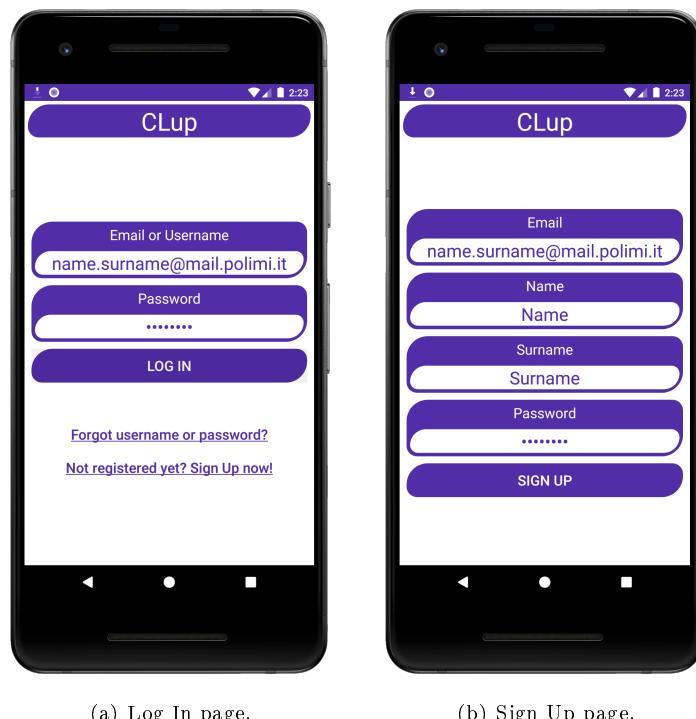
- [D1]: Customers respect the d.P.C.m impositions.
- [D2]: If customers have lined up from remote, they shall approach to the store with the smartphone.
- [D3]: If customers indicate the category of products they would buy, they won't buy other things.
- [D4]: Customers lining up remotely shall have a Global Positioning System (GPS) module inside the smartphone.
- [D5]: Customers lining up remotely shall accept GPS localization permissions.
- [D6]: Customers lining up remotely shall keep Internet connection active.
- [D7]: Customers lining up remotely shall keep notification option active.
- [D8]: Customers enter in the store only if the system authorized them.
- [D9]: Customers go away from the store after they have done their shopping.
- [D10]: Customers lining up from the physical spot take care about the printed QR code.
- [D11]: Customers show the QR code to the scanner to be accepted by the system.

# Chapter 3

## Specific Requirements

### 3.1 External Interface Requirements

#### 3.1.1 User Interfaces



(a) Log In page.

(b) Sign Up page.

Figure 3.1: Example of Log In and Sign Up pages.

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## CHAPTER 3. SPECIFIC REQUIREMENTS

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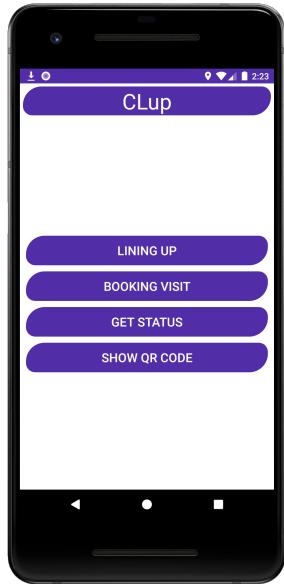
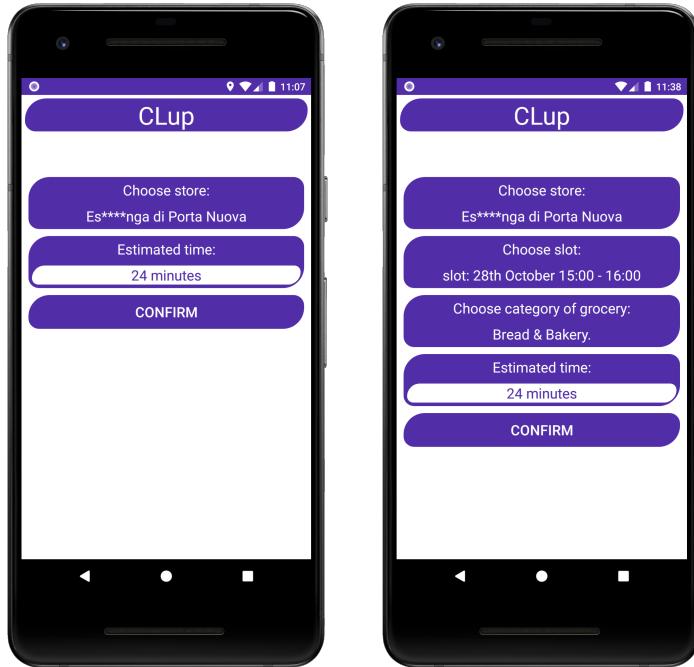


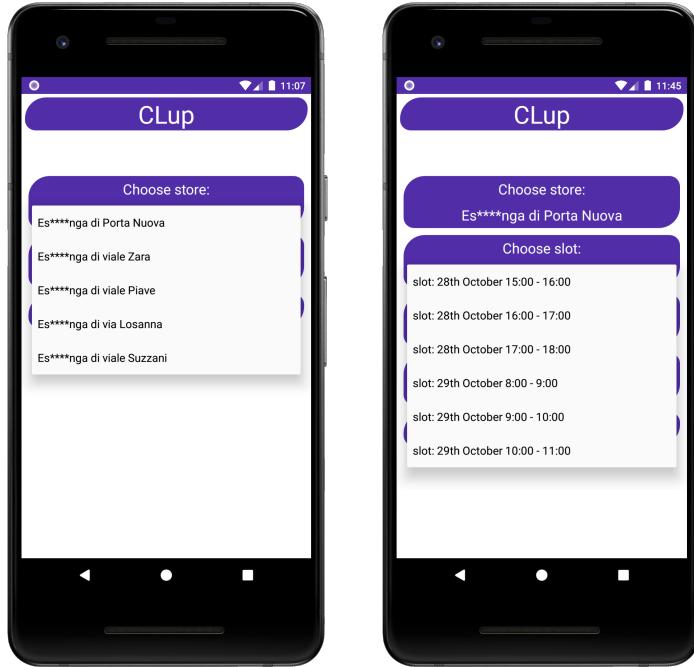
Figure 3.2: Home page.

## CHAPTER 3. SPECIFIC REQUIREMENTS



(a) Lining Up page.

(b) Booking Visit page.



(c) Lining Up page with expanded spinner.  
(d) Booking Visit page with expanded spinner.

Figure 3.3: Example of Lining Up and Booking Visit pages.



(a) Get Status page.

(b) Show QR code page.

Figure 3.4: Example of Get Status and Show QR code pages.

### 3.1.2 Hardware Interfaces

### 3.1.3 Software interfaces

### 3.1.4 Communications Interfaces

## 3.2 Functional Requirements

### 3.2.1 Requirements

Bla bla bla...

## CHAPTER 3. SPECIFIC REQUIREMENTS

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|                           |   |
|---------------------------|---|
| <b>Goal</b>               | <b>G1: Keep customers in safe condition w.r.t the d.P.C.m in force inside the store.</b>  |
| <b>Requirements</b>       | <ul style="list-style-type: none"> <li>• [R]: The system has to</li> </ul>  |
| <b>Domain Assumptions</b> | <ul style="list-style-type: none"> <li>• [D]: There is a d.P.C.m in force.</li> <li>• [D]: Customers follow the rules imposed by the d.P.C.m in force.</li> <li>• [D]: Customers enter in the store only if the system, or the store manager, authorizes them.</li> <li>• [D]: Customers don't stay in the shop longer than necessary.</li> <li>• [D]: If customers booked a visit to the store and they specify the category of grocery, they won't buy other things.</li> </ul> |

|                           |   |
|---------------------------|---|
| <b>Goal</b>               | <b>G2: Limit the physical line situation in the proximity of the store</b>  |
| <b>Requirements</b>       | <ul style="list-style-type: none"> <li>• [R]: The system has to estimate the residence time, of a customer, in the store.</li> <li>• [R]: The system has to estimate the time needed to arrive, to the store, from the position of the customer.</li> <li>• [R]: The system has to monitor the global position of the customers.</li> <li>• [R]: The system has to limit the number of releasable QR code if imposed by the store manager.</li> </ul> |
| <b>Domain Assumptions</b> | <ul style="list-style-type: none"> <li>• [D]: Customers line up physically only if they have a valid (non expired) QR code.</li> <li>• [D]: Customers go away from the store after they have done their shopping.</li> <li>• [D]: Outside the store, there is space to queue.</li> </ul>  |

## CHAPTER 3. SPECIFIC REQUIREMENTS

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| Goal                      | G3: Allow customers to line up from a remote device.  |
|---------------------------|---|
| <b>Requirements</b>       | <ul style="list-style-type: none"> <li>• [R]: The application has to allow user to register and to log in the application.</li> <li>• [R]: The application has to implement the possibility to line up remotely.</li> <li>• [R]: The application has to store locally the QR code.</li> <li>• [R]: The application has to implement the possibility to delete a lining up operation.</li> <li>• [R]:</li> </ul>   |
| <b>Domain Assumptions</b> | <ul style="list-style-type: none"> <li>• [D]: The customers have a smartphone.</li> <li>• [D]: The customers have installed the Customers Line-up (CLup) application.</li> <li>• [D]: The customers have a GPS module inside the smartphone.</li> <li>• [D]: The customers allow the permissions requested by the application.</li> <li>• [D]: The customers keep Internet connection active.</li> <li>• [D]: The customers keep notification option active.</li> <li>• [D]:</li> </ul> |

## CHAPTER 3. SPECIFIC REQUIREMENTS

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| Goal               | G4: Allow store manager to monitor entrances.   |
|--------------------|---|
| Requirements       | <ul style="list-style-type: none"> <li>• [R]: The application has to allow the store manager to log in the application.</li> <li>• [R]: The application has to show, to the store manager, analytical data concerning the influx of people to the store.</li> <li>• [R]: The system has to allow, to the store manager, the possibility to limit the number of QR code released.</li> <li>• [R]: The application shall allow the store manager to scan the QR codes.</li> <li>• [R]:</li> </ul> |
| Domain Assumptions | <ul style="list-style-type: none"> <li>• [D]: The store manager has a smartphone.</li> <li>• [D]: The store manager has installed the CLUp application.</li> <li>• [D]: The store manager allows the permissions requested by the application.</li> <li>• [D]: The store manager keeps Internet connection active.</li> <li>• [D]: There is always a store manager present in the store.</li> </ul>   |

| Goal               | G5: Allow customers to line up from a physical spot.  |
|--------------------|---|
| Requirements       | <ul style="list-style-type: none"> <li>• [R]: A physical spot shall be installed outside the store.</li> <li>• [R]: The physical spot has to run the CLUp application.</li> <li>• [R]: The physical spot must be registered and logged in the application.</li> <li>• [R]: The physical spot has to print the QR code.</li> <li>• [R]: The physical spot shall allow customers to line up.</li> </ul> |
| Domain Assumptions | <ul style="list-style-type: none"> <li>• [D]: Physical spot is powered on every working day.</li> <li>• [D]:</li> </ul>   |

## CHAPTER 3. SPECIFIC REQUIREMENTS

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| <b>Goal</b>               | <b>G6: Allow customers to book a visit from a remote device.</b>  |
|---------------------------|---|
| <b>Requirements</b>       | <ul style="list-style-type: none"> <li>• [R]: The application has to allow user to register and to log in the application.</li> <li>• [R]: The application has to implement the possibility to book a visit remotely.</li> <li>• [R]: The application has to store locally the QR code.</li> <li>• [R]: The application has to implement the possibility to delete a book a visit operation.</li> <li>• [R]: The application shall allow users to specify the category of grocery they want to buy.</li> <li>• [R]: The application shall allow users to specify the date of the visit and the store where they will want to go.</li> <li>• [R]:</li> </ul> |
| <b>Domain Assumptions</b> | <ul style="list-style-type: none"> <li>• [D]: The customers have a smartphone.</li> <li>• [D]: The customers have installed the CLUp application.</li> <li>• [D]: The customers have a GPS module inside the smartphone.</li> <li>• [D]: The customers allow the permissions requested by the application.</li> <li>• [D]: The customers keep Internet connection active.</li> <li>• [D]: The customers keep notification option active.</li> <li>• [D]:</li> </ul>   |

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| Goal               | G7: Infer customers visits duration.   |
|--------------------|--|
| Requirements       | <ul style="list-style-type: none"> <li>• [R]: The application shall allow the store manager to scan the QR code of the customers.</li> <li>• [R]: The system has to store the time in which the customers' QR code has been scanned.</li> <li>• [R]: The system has to track the GPS position of the customers to estimate when they are out of the store.</li> <li>• [R]: The system has to store the time in which the customers left the store.</li> </ul>                          |
| Domain Assumptions | <ul style="list-style-type: none"> <li>• [D]: The store manager scan the QR code of the customers when they enter in the store.</li> <li>• [D]: The customers have a smartphone.</li> <li>• [D]: The customers have installed the CLup application.</li> <li>• [D]: The customers have a GPS module inside the smartphone.</li> <li>• [D]: The customers allow the permissions requested by the application.</li> <li>• [D]: The customers keep Internet connection active.</li> </ul> |

### 3.2.2 Definition of Use Case Diagrams

Bla bla bla...

## CHAPTER 3. SPECIFIC REQUIREMENTS

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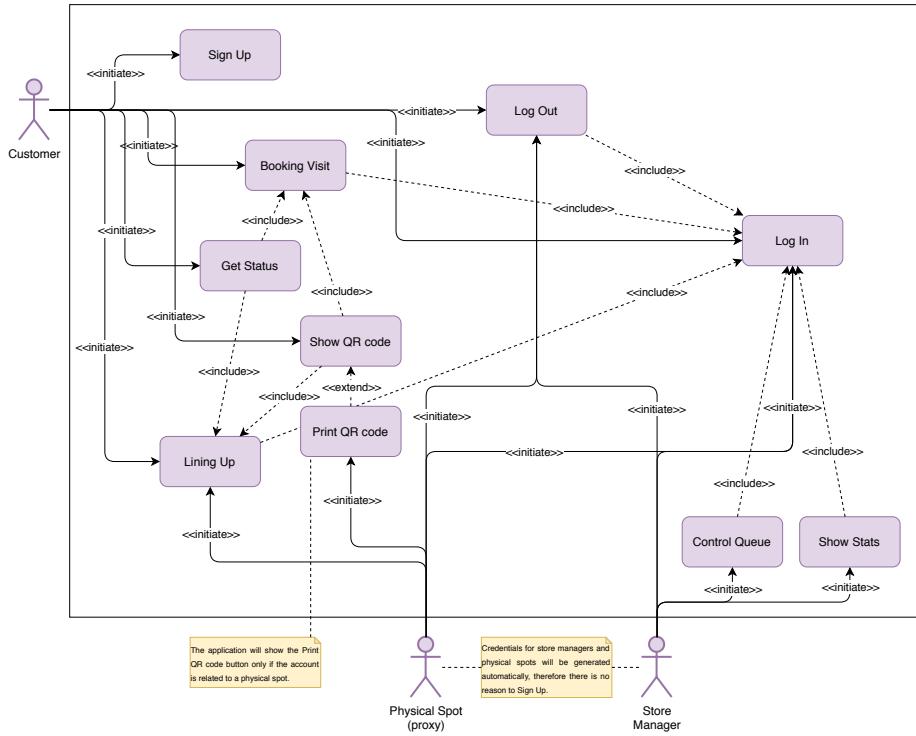


Figure 3.5: Use cases diagram.

|                         |   |
|-------------------------|---|
| <b>Name</b>             | Sign Up   |
| <b>Actor</b>            | Customer  |
| <b>Entry Conditions</b> | Customer is on the Sign Up page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>Customer inserts the requested information in the form.</li> <li>Customer clicks on the Sign Up button.</li> </ul>                               |
| <b>Exit Conditions</b>  | Sign Up completed successfully and customer is logged in, then the application shows the Home page.   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>Customer's username already in use.</li> <li>Empty form field.</li> <li>Policy agreement rejected.</li> <li>Lost Internet connection.</li> </ul> |

Table 3.1: Use case: **Sign Up**.

## CHAPTER 3. SPECIFIC REQUIREMENTS

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|                         |   |
|-------------------------|---|
| <b>Name</b>             | Log In  |
| <b>Actor</b>            | Customer - Physical Spot - Store Manager  |
| <b>Entry Conditions</b> | Actor is on the Log In page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Actor inserts the requested information in the form.</li> <li>• Actor clicks on the Log In button.</li> </ul>        |
| <b>Exit Conditions</b>  | Log In completed successfully and actor is redirected to the Home page.   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Actor's username or password incorrect.</li> <li>• Empty form field.</li> <li>• Lost Internet connection.</li> </ul> |

Table 3.2: Use case: **Log In**.

|                         |  |
|-------------------------|--|
| <b>Name</b>             | Log Out  |
| <b>Actor</b>            | Customer - Physical Spot - Store Manager   |
| <b>Entry Conditions</b> | Actor is on the Log Out page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Actor clicks on the Log Out button.</li> </ul>                            |
| <b>Exit Conditions</b>  | Log Out completed successfully and actor is redirected to the Log In page.   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Actor already logged out.</li> <li>• Lost Internet connection.</li> </ul> |

Table 3.3: Use case: **Log Out**.

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|                         |   |
|-------------------------|---|
| <b>Name</b>             | Lining Up   |
| <b>Actor</b>            | Customer - Physical Spot  |
| <b>Entry Conditions</b> | Actor is on the Home page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Actor clicks on the Lining Up button.</li> <li>• Actor inserts the requested data in the form.</li> <li>• Actor clicks on the confirmation button.</li> </ul>  |
| <b>Exit Conditions</b>  | Lining Up completed successfully, the application returns the Status page.  |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Previous Lining Up action was not expired (only in case of remote customer).</li> <li>• Previous Booking Visit action was not expired (only in case of remote customer).</li> <li>• Actor wasn't logged.</li> <li>• Lost Internet connection.</li> </ul> |

Table 3.4: Use case: **Lining Up**.

|                         |  |
|-------------------------|--|
| <b>Name</b>             | Booking Visit  |
| <b>Actor</b>            | Customer   |
| <b>Entry Conditions</b> | Customer is on the Home page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Customer clicks on the Booking Visit button.</li> <li>• Customer fills the form with the requested data.</li> <li>• Customer clicks on the Submit button.</li> </ul>                    |
| <b>Exit Conditions</b>  | Booking Visit completed successfully and the application returns, to the customer, the Status page.  |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Previous Lining Up action was not expired.</li> <li>• Previous Booking Visit action was not expired.</li> <li>• Customer wasn't logged.</li> <li>• Lost Internet connection.</li> </ul> |

Table 3.5: Customer - use case: **Booking Visit**.

## CHAPTER 3. SPECIFIC REQUIREMENTS

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|                         |  |
|-------------------------|--|
| <b>Name</b>             | Show QR code - Print QR code   |
| <b>Actor</b>            | Customer - Physical Spot   |
| <b>Entry Conditions</b> | Actor is on the Home page.   |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>Actor clicks on the Show QR (Print QR) code button.</li> </ul>  |
| <b>Exit Conditions</b>  | The application shows (print) the QR code.   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>QR code wasn't saved on the application correctly (only in case of remote customer).</li> <li>No Lining Up, or Booking Visit, action previously performed (only in case of remote customer).</li> <li>Actor wasn't logged.</li> <li>Spot finished the paper.</li> <li>Spot finished the ink.</li> </ul> |

Table 3.6: Use case: **Show QR code - Print QR code**.

|                         |  |
|-------------------------|--|
| <b>Name</b>             | Get Status   |
| <b>Actor</b>            | Customer   |
| <b>Entry Conditions</b> | Customer is on the Home page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>Customer clicks on the Get Status button.</li> </ul>  |
| <b>Exit Conditions</b>  | The application returns the Get Status page showing information about the last Lining Up, or Booking Visit, operation.   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>No operation previously performed, therefore there is no data to show.</li> <li>Customer wasn't logged.</li> <li>Lost Internet connection.</li> </ul> |

Table 3.7: Customer - use case: **Get Status**.

### CHAPTER 3. SPECIFIC REQUIREMENTS

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|                         |   |
|-------------------------|---|
| <b>Name</b>             | Control Queue   |
| <b>Actor</b>            | Store Manager   |
| <b>Entry Conditions</b> | Store Manager is on the Home page.  |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Store Manager clicks on the Control Queue button.</li> </ul>                 |
| <b>Exit Conditions</b>  | The application returns the Control Queue page showing options to manage the queue.                                   |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Store Manager wasn't logged.</li> <li>• Lost Internet connection.</li> </ul> |

Table 3.8: Store Manager - use case: **Control Queue**.

|                         |  |
|-------------------------|--|
| <b>Name</b>             | Show Stats   |
| <b>Actor</b>            | Store Manager  |
| <b>Entry Conditions</b> | Store Manager is on the Home page.   |
| <b>Event Flows</b>      | <ul style="list-style-type: none"> <li>• Store Manager clicks on the Show Stats button.</li> </ul>   |
| <b>Exit Conditions</b>  | The application returns the Show Stats page showing information about the number of customers inside the store, the length of the queue and other information about the waiting time in queue. |
| <b>Exceptions</b>       | <ul style="list-style-type: none"> <li>• Store Manager wasn't logged.</li> <li>• Lost Internet connection.</li> </ul>  |

Table 3.9: Store Manager - use case: **Show Stats**.

### 3.2.3 Use Cases and Sequence/Activity Diagrams

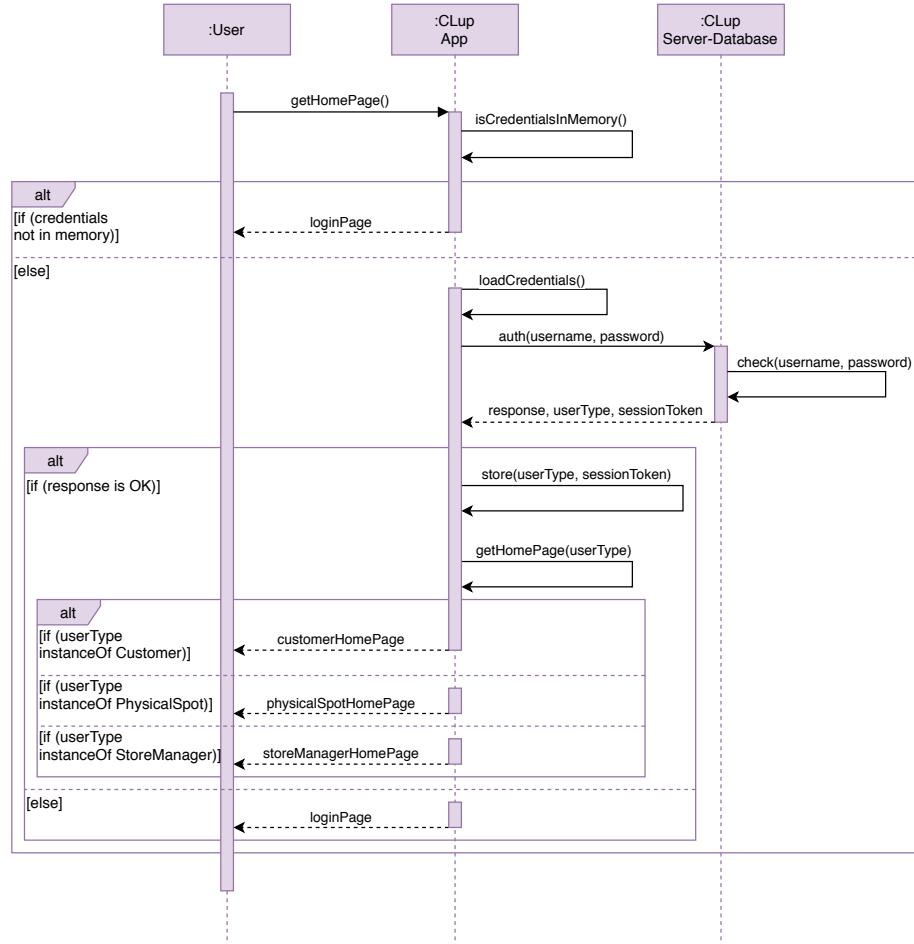


Figure 3.6: Home page sequence diagram.

## CHAPTER 3. SPECIFIC REQUIREMENTS

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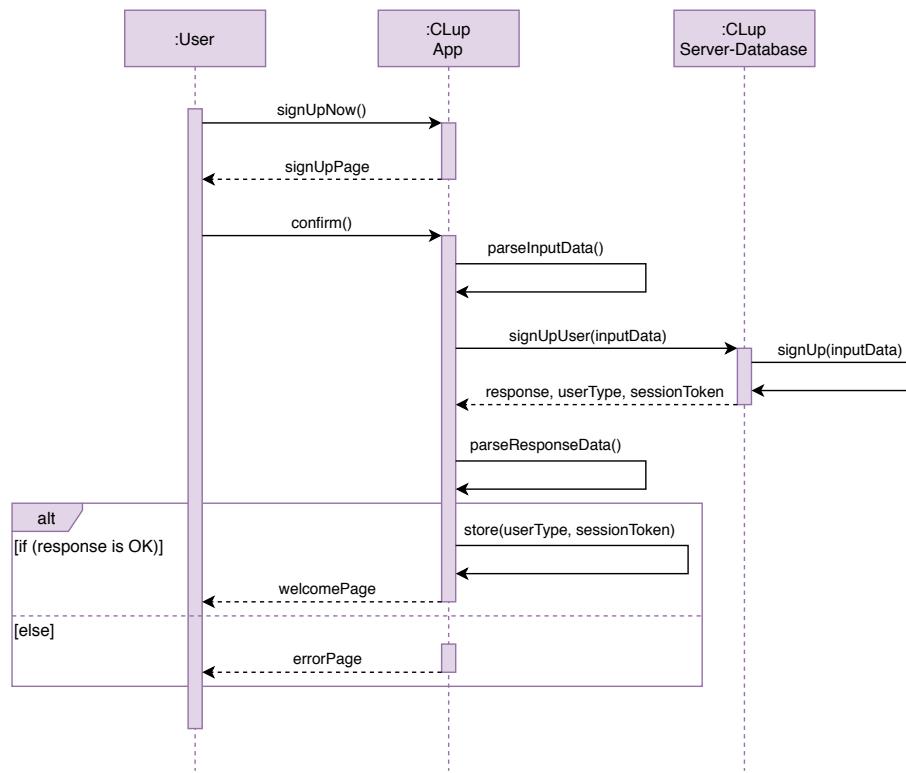


Figure 3.7: Sign Up sequence diagram.

## CHAPTER 3. SPECIFIC REQUIREMENTS

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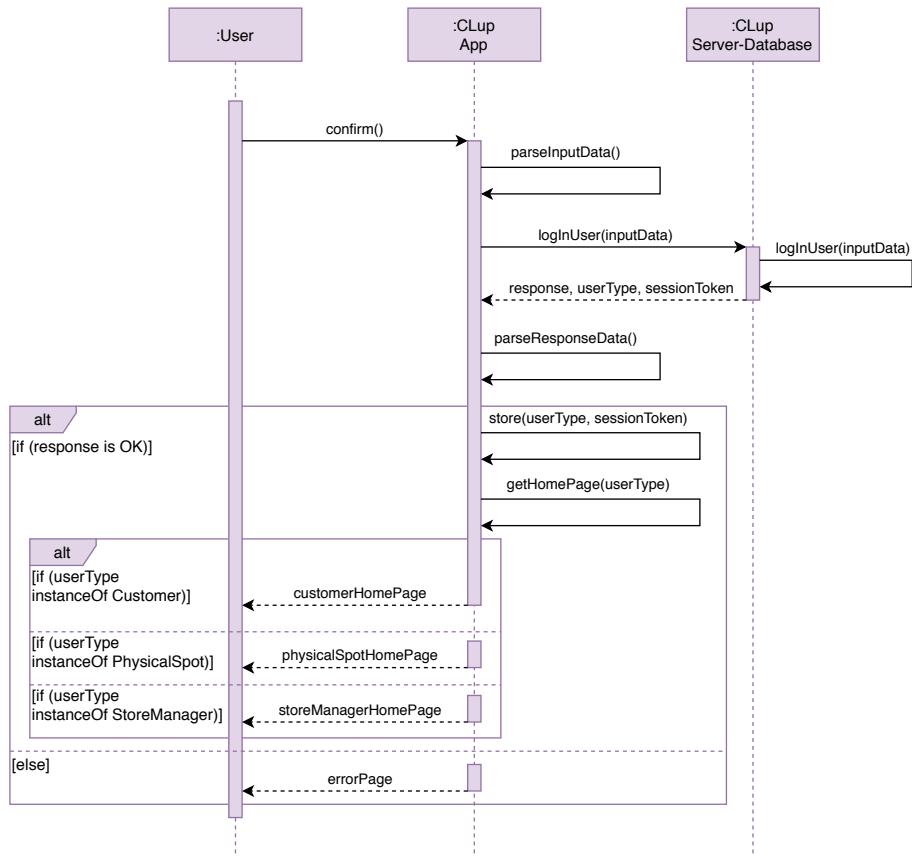


Figure 3.8: Log In sequence diagram.

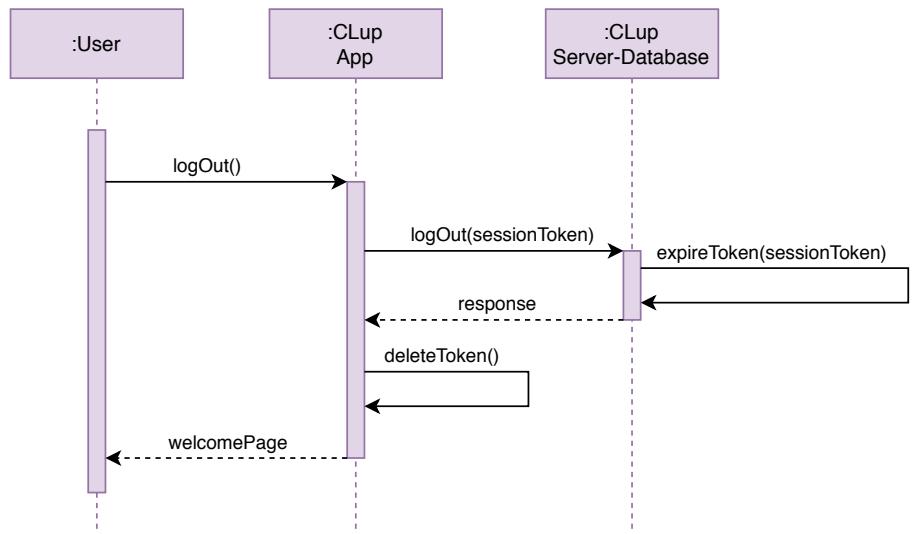


Figure 3.9: Log Out sequence diagram.

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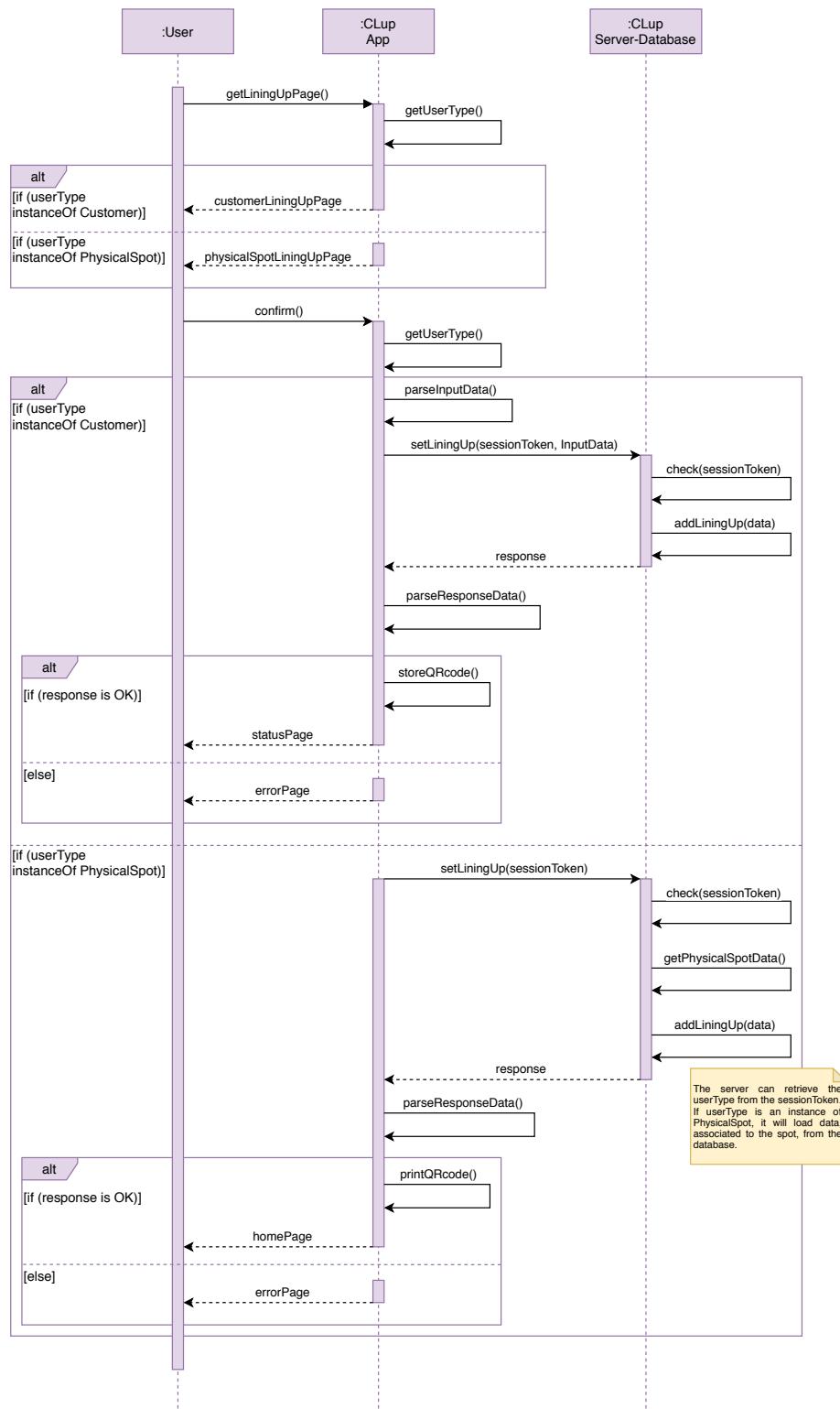


Figure 3.10: Lining Up sequence diagram.

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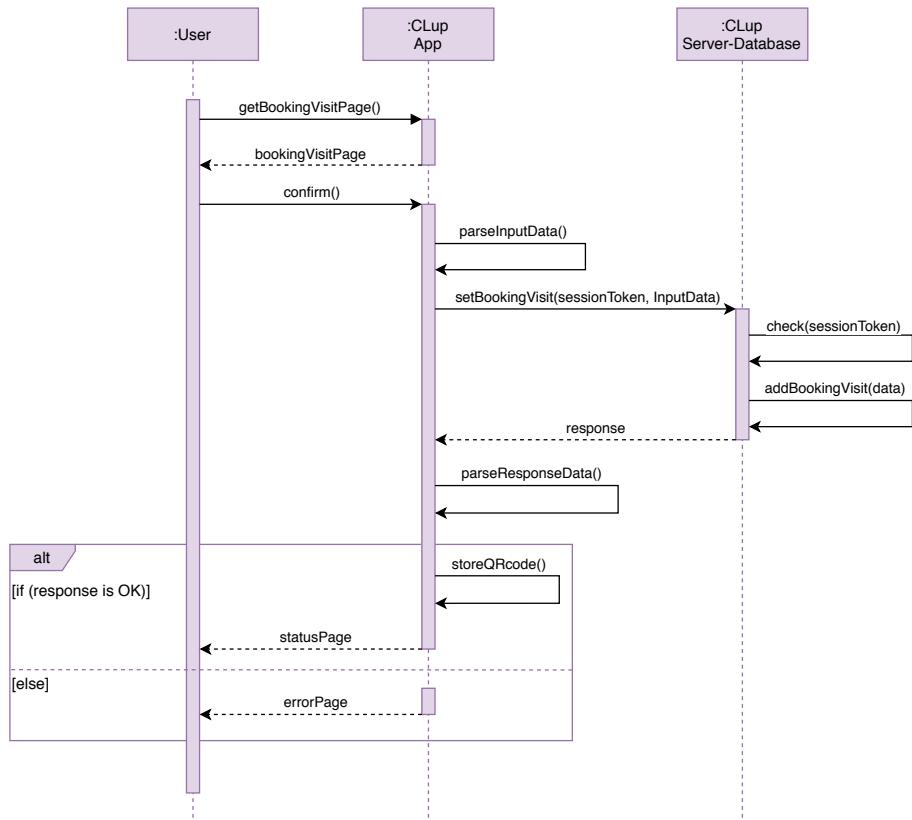


Figure 3.11: Booking a Visit sequence diagram.

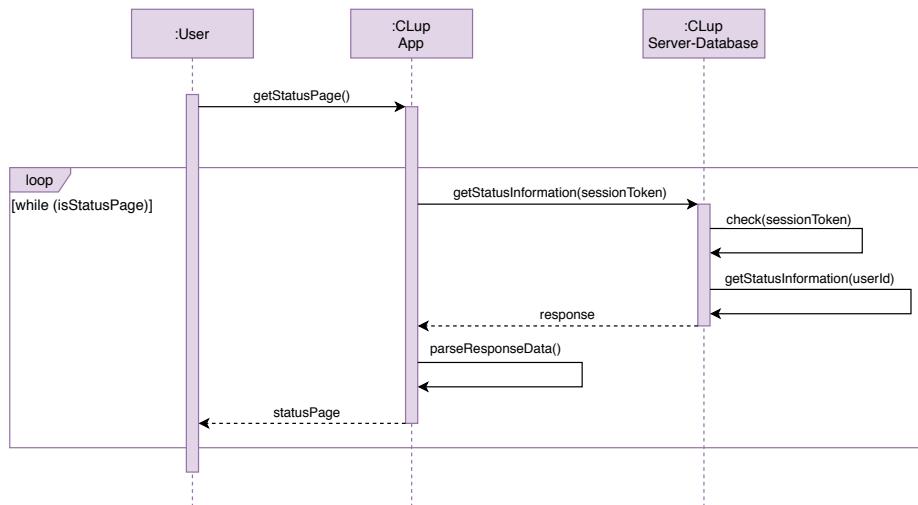


Figure 3.12: Get Status sequence diagram.

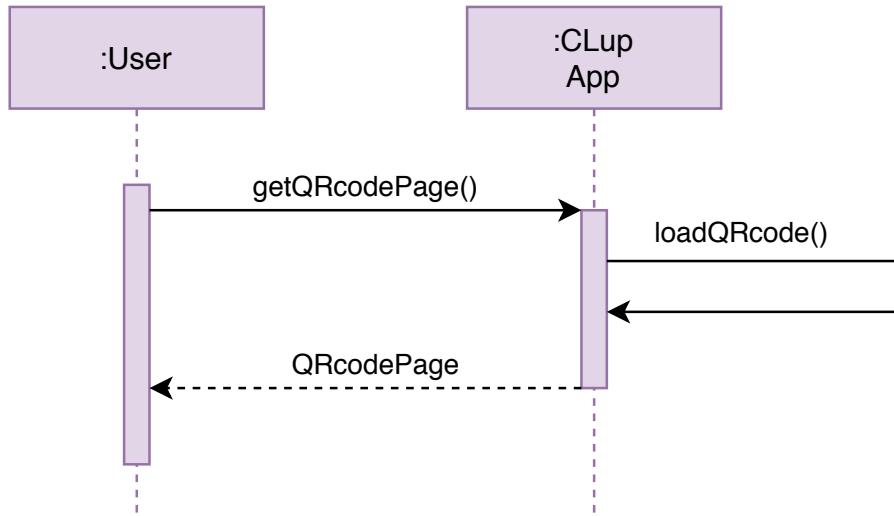


Figure 3.13: QR code page sequence diagram.

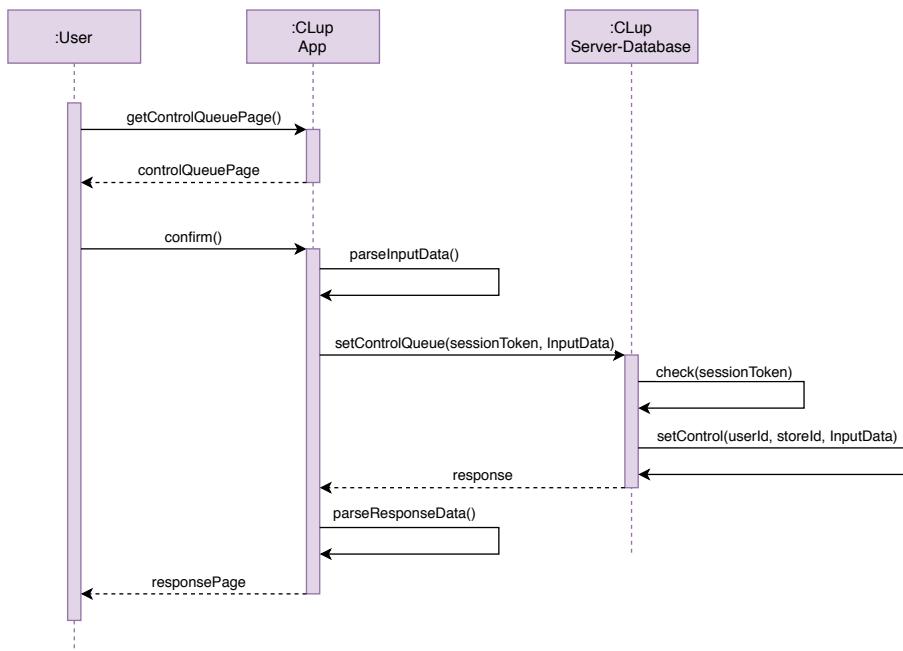


Figure 3.14: Control Queue sequence diagram.

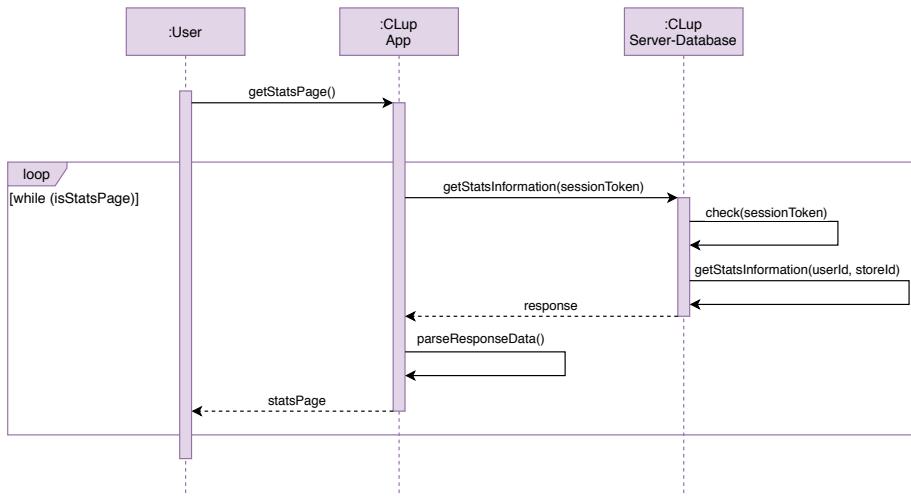


Figure 3.15: Show Stats sequence diagram.

### 3.2.4 Mapping on Requirements

## 3.3 Performance Requirements

## 3.4 Design Constraints

### 3.4.1 Standard Compliance

### 3.4.2 Hardware limitations

### 3.4.3 Any Other Constraint

## 3.5 Software System Attributes

### 3.5.1 Reliability

### 3.5.2 Availability

### 3.5.3 Security

### 3.5.4 Maintainability

### 3.5.5 Portability

# Chapter 4

## Formal Analysis Using Alloy

# Chapter 5

## Effort Spent

# Chapter 6

## References

# Glossary

CLup      Customers Line-up

d.P.C.m    *"decreto del Presidente del Consiglio dei ministri"*

GPS        Global Positioning System