



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

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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:

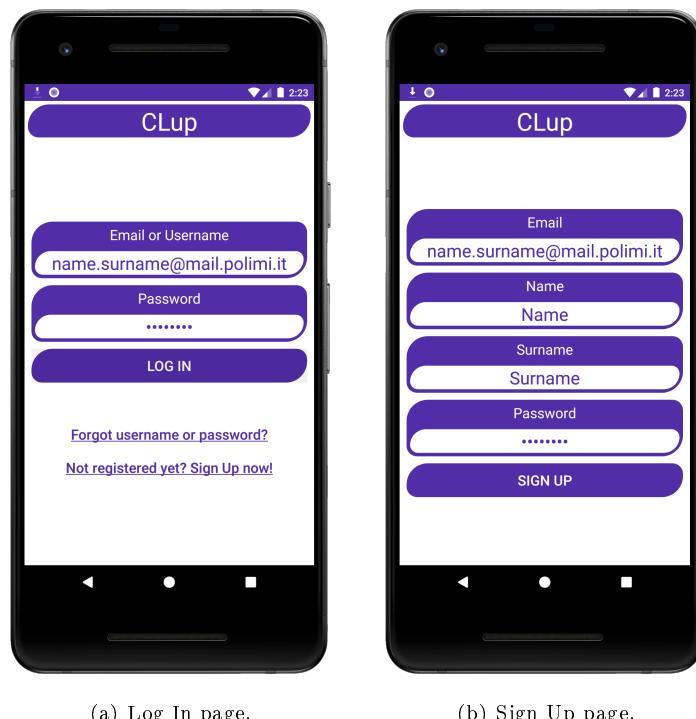
- [D1]: Customers respect the d.P.C.m impositions.
- [D2]: If customers have lined up from remote, they shall approach to the store with the smartphone.
- [D3]: If customers indicate the category of products they would buy, they won't buy other things.
- [D4]: Customers lining up remotely shall have 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.

CHAPTER 3. SPECIFIC REQUIREMENTS

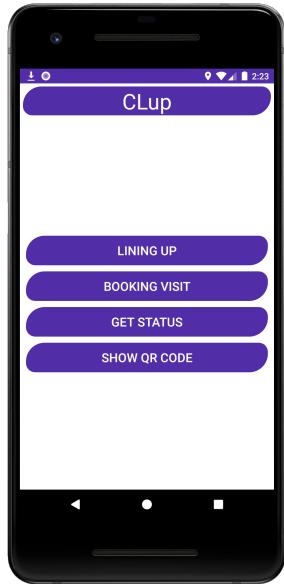
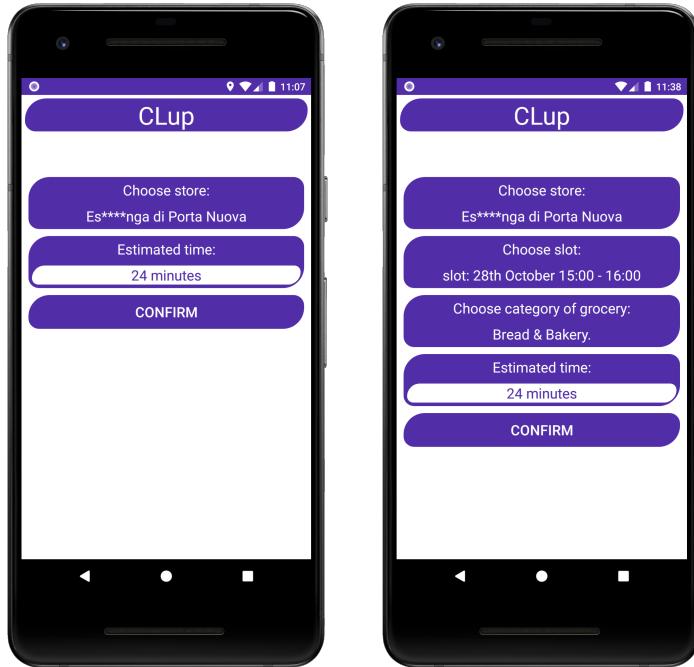


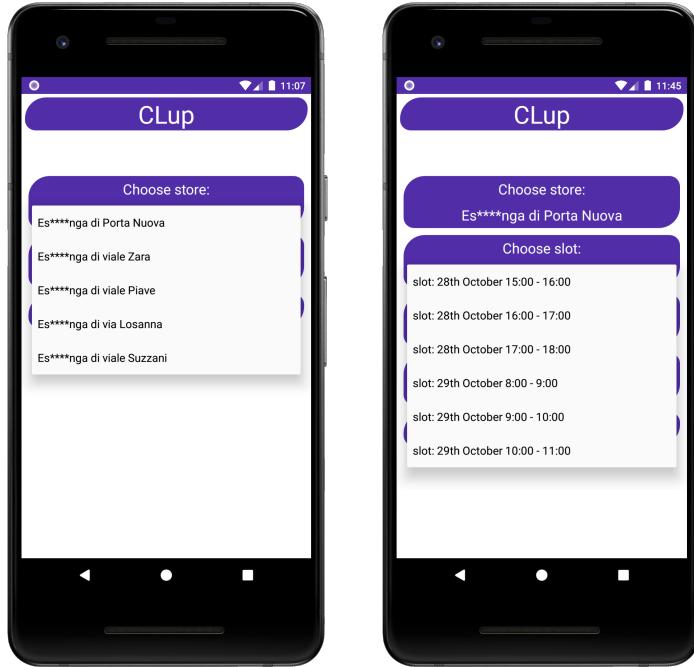
Figure 3.2: Home page.

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

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CHAPTER 3. SPECIFIC REQUIREMENTS

Goal	G1: Keep customers in safe condition w.r.t the d.P.C.m in force inside the store.
Requirements	<ul style="list-style-type: none"> • [R]: The system has to schedule entrances to the store. • [R]: The system has to compute the maximum capacity of the store w.r.t. the social distances imposed by the d.P.C.m in force. • [R]: The system has to monitor the customers residence time in the store. • [R]: The system has to allow authorized customers to enter in the store. • [R]: The system has to deny unauthorized customers to enter in the store. • [R]: The system has to know when a customer enters in the store. • [R]: The system has to know when a customer has left the store.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: There is a d.P.C.m in force. • [D]: Customers follow the rules imposed by the d.P.C.m in force. • [D]: Customers enter in the store only if the system authorizes them. • [D]: Customers don't stay in the shop longer than necessary.

CHAPTER 3. SPECIFIC REQUIREMENTS

Goal	G2: Limit the physical line situation in the proximity of the store
Requirements	<ul style="list-style-type: none"> • [R]: The system has to estimate the residence time, of a customer, in the store. • [R]: The system has to infer the residence time of the customers based on past purchases. • [R]: The system has to estimate the time needed to arrive, to the store, from the position of the customer. • [R]: The system has to track the global position of the customers. • [R]: The system has to release QR codes to the customers. • [R]: The system has to limit the number of releasable QR codes if imposed by the store manager. • [R]: The system has to allow the store manager to monitor the status of the queue. • [R]: The system has to notify customers about the remaining time to be authorized to enter in the store. • [R]: The system has to communicate which is the next served QR code number.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: Customers line up physically only if they have a valid (non expired) QR code. • [D]: Customers go away from the store after they have done their shopping. • [D]: Outside the store, there is space to queue.

CHAPTER 3. SPECIFIC REQUIREMENTS

Goal	G3: Allow customers to line up from a remote device.
Requirements	<ul style="list-style-type: none"> • [R]: The system has to allow customers to register to the application. • [R]: The system has to allow customers to login to the application. • [R]: The system has to allow customers to get a QR code from the application. • [R]: The system has to release QR codes to the customers through the application. • [R]: The system has to alert customers if the queue is full. • [R]: The system has to encode the lining up number in the QR code. • [R]: The system has to allow customers to watch the QR code from the application. • [R]: The system has to allow customers to watch the lining up number encoded in the QR code. • [R]: The system has to allow customers to watch the remaining time to be authorized to enter in the store. • [R]: The system has to update the remaining time showed to the customers. • [R]: The system has to allow customers to delete a lining up operation. • [R]: The system has to notify customers about the validation status of the QR code. • [R]: The system has to check if customers have Internet connection active. • [R]: The system has to check if customers have allowed the permissions requested by the application.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: Customers have a smartphone. • [D]: Customers have installed the Customers Line-up (CLup) application. • [D]: Customers allow the permissions requested by the application. • [D]: Customers keep Internet connection active.

CHAPTER 3. SPECIFIC REQUIREMENTS

Goal	G4: Allow store manager to monitor entrances.
Requirements	<ul style="list-style-type: none"> • [R]: The system has to register store managers in the application. • [R]: The system has to allow store managers to login to the application. • [R]: The system has to allow store managers to monitor the status of the queue. • [R]: The system has to allow store managers to limit the number of QR codes released. • [R]: The system has to allow store managers to monitor the number of customers inside the store. • [R]: The system has to allow store managers to scan the QR codes of the customers. • [R]: The system has to allow store managers to modify the timing parameters of the scheduler. • [R]: The system has to check if store managers have Internet connection active. • [R]: The system has to check if store managers have allowed the permissions requested by the application.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: There is a store manager present in the store. • [D]: Store managers allow the permissions requested by the application. • [D]: Store managers keep Internet connection active.

CHAPTER 3. SPECIFIC REQUIREMENTS

Goal	G5: Allow customers to line up from a physical spot.
Requirements	<ul style="list-style-type: none"> • [R]: The system has to allow unregistered customers to line up. • [R]: The system has to allow customers to get a QR code from a physical spot. • [R]: The system has to release QR codes to the customers through the physical spot. • [R]: The system has to encode the lining up number in the QR code. • [R]: The system has to print QR codes on a paper tickets. • [R]: The system has to alert customers if the queue is full. • [R]: The system has to alert when the paper and toner of the physical spot is going to finish.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: Physical spots are powered on every working day. • [D]: Physical spots are refilled when asked by the system.

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Goal	G6: Allow customers to book a visit from a remote device.
Requirements	<ul style="list-style-type: none"> • [R]: The system has to allow customers to register to the application. • [R]: The system has to allow customers to login to the application. • [R]: The system has to allow customers to get a QR code from the application. • [R]: The system has to allow customers to specify the date and time for a visit to the store. • [R]: The system has to allow customers to specify the category of grocery they want to buy. • [R]: The system has to release QR codes to the customers through the application. • [R]: The system has to alert customers if the queue is full. • [R]: The system has to encode the book-a-visit number in the QR code. • [R]: The system has to allow customers to watch the QR code from the application. • [R]: The system has to allow customers to watch the book-a-visit number encoded in the QR code. • [R]: The system has to allow customers to watch the remaining time to be authorized to enter in the store. • [R]: The system has to allow customers to delete a book-a-visit operation. • [R]: The system has to notify customers about the validation status of the QR code. • [R]: The system has to check if customers have Internet connection active. • [R]: The system has to check if customers have allowed the permissions requested by the application.
Domain Assumptions	<ul style="list-style-type: none"> • [D]: Customers have a smartphone. • [D]: Customers have installed the CLup application. • [D]: Customers allow the permissions requested by the application. • [D]: Customers keep Internet connection active.

3.2.2 Definition of Use Case Diagrams

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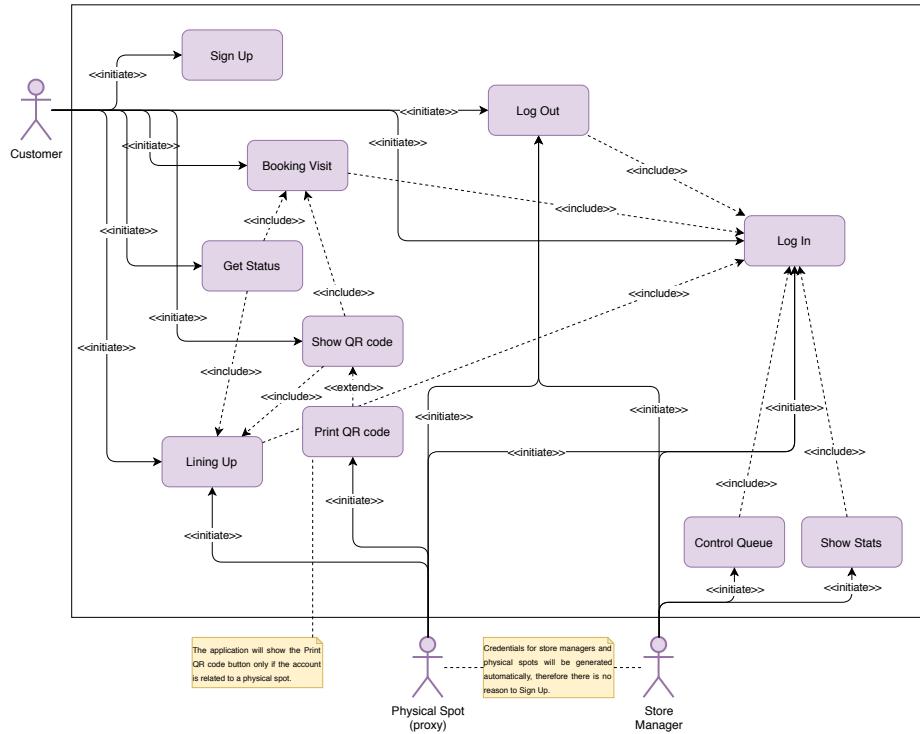


Figure 3.5: Use cases diagram.

CHAPTER 3. SPECIFIC REQUIREMENTS

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

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

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

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

CHAPTER 3. SPECIFIC REQUIREMENTS

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

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

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

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

CHAPTER 3. SPECIFIC REQUIREMENTS

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

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

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

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

CHAPTER 3. SPECIFIC REQUIREMENTS

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

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

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

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

CHAPTER 3. SPECIFIC REQUIREMENTS

Name	Show Stats
Actor	Store Manager
Entry Conditions	Store Manager is on the Home page.
Event Flows	<ul style="list-style-type: none">• Store Manager clicks on the Show Stats button.
Exit Conditions	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.
Exceptions	<ul style="list-style-type: none">• Store Manager wasn't logged.• Lost Internet connection.

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

3.2.3 Use Cases and Sequence/Activity Diagrams

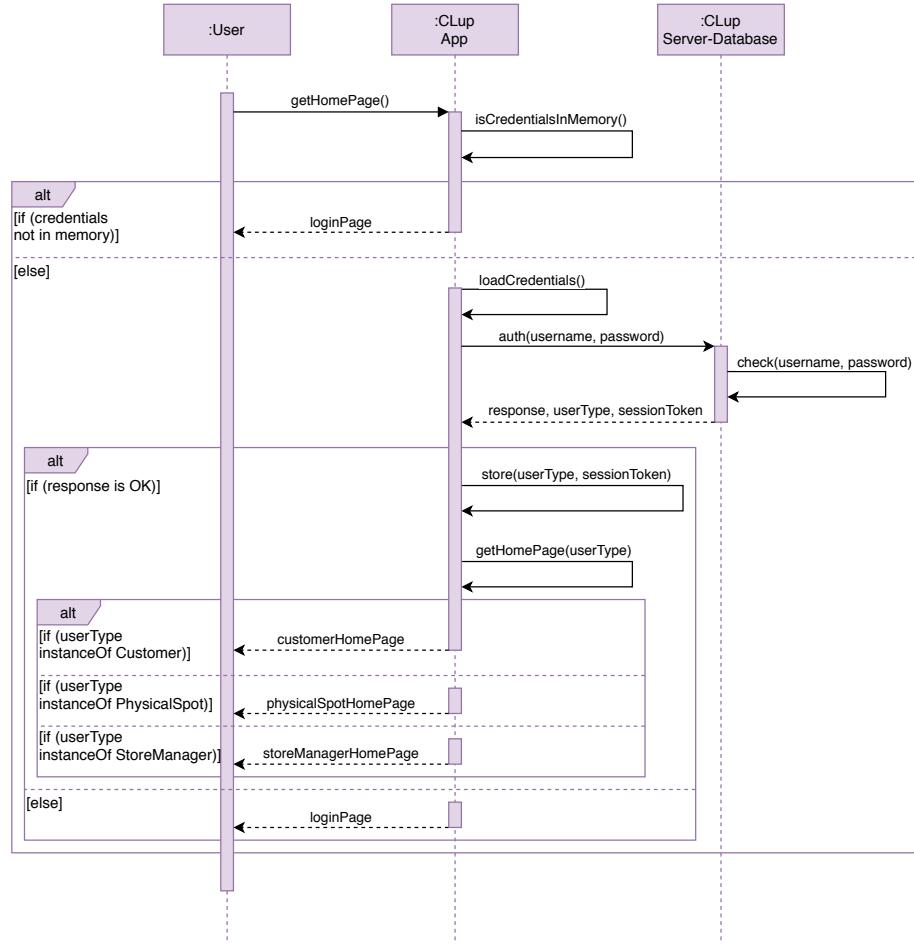


Figure 3.6: Home page sequence diagram.

CHAPTER 3. SPECIFIC REQUIREMENTS

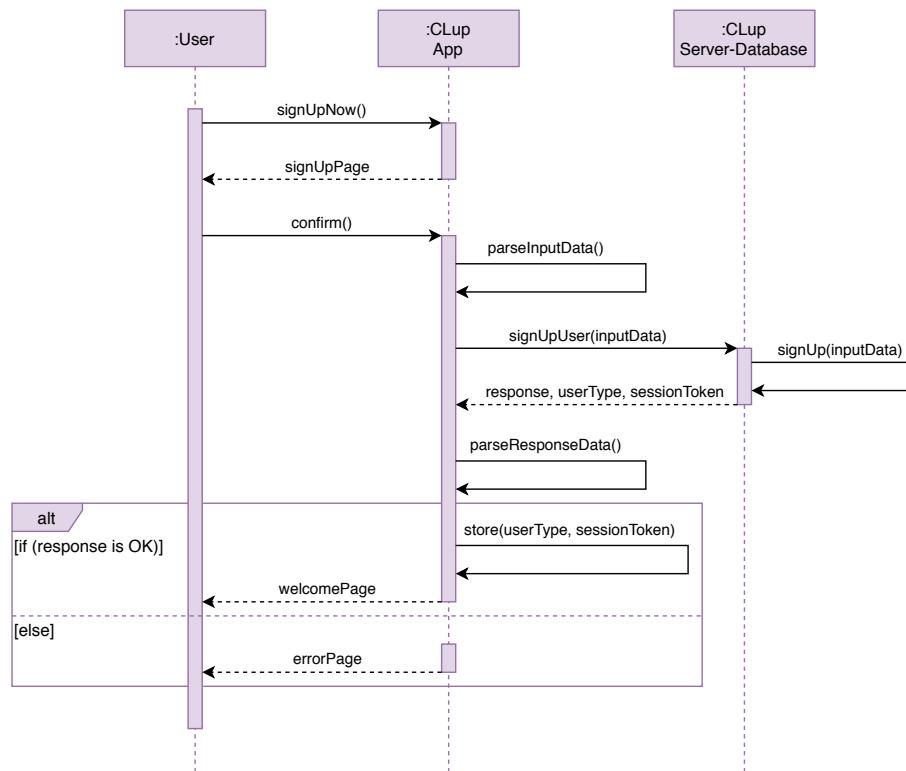


Figure 3.7: Sign Up sequence diagram.

CHAPTER 3. SPECIFIC REQUIREMENTS

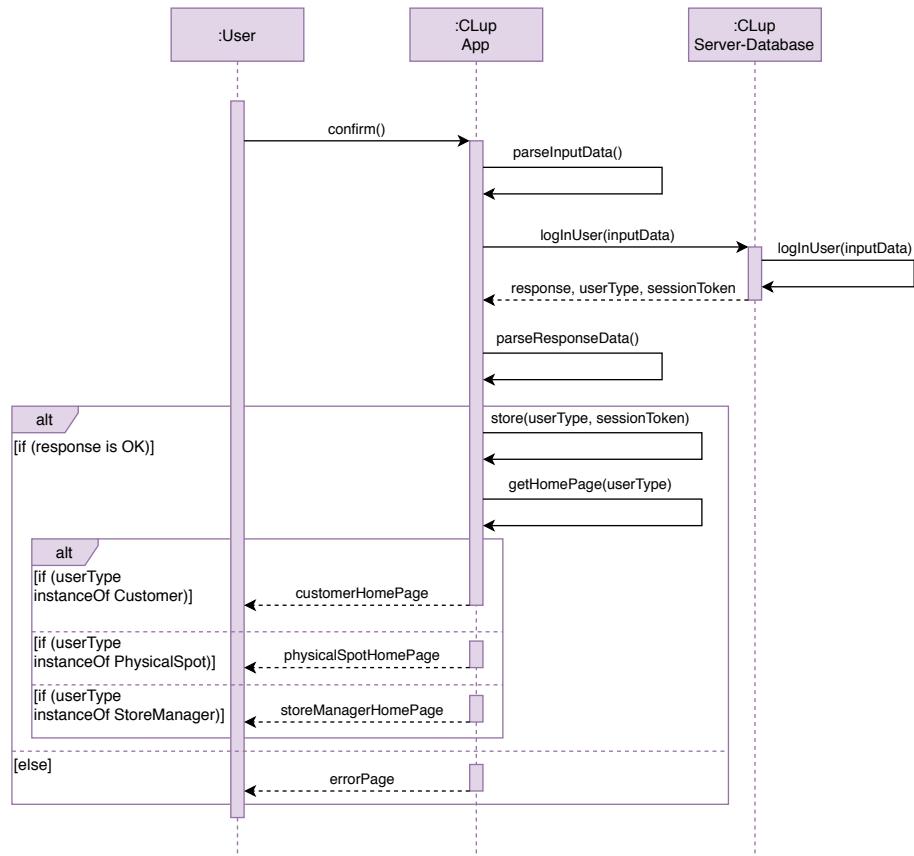


Figure 3.8: Log In sequence diagram.

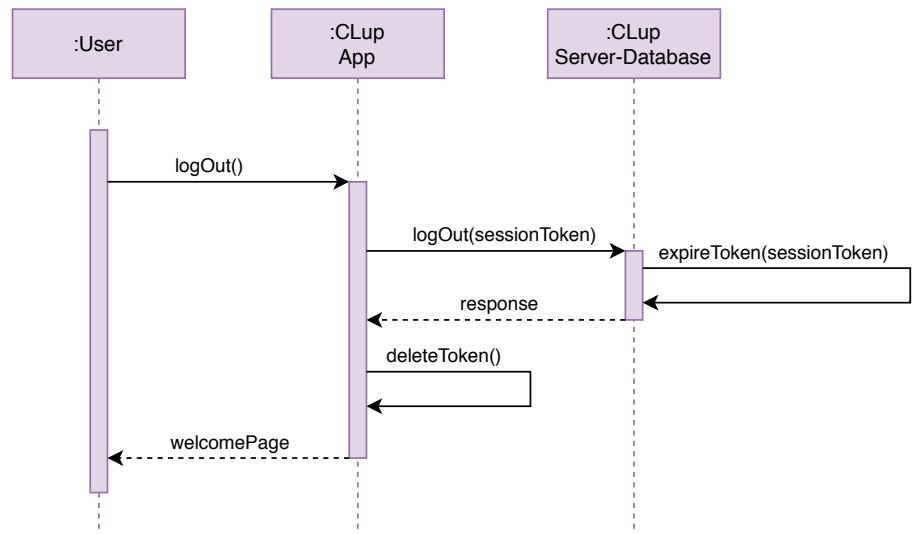


Figure 3.9: Log Out sequence diagram.

CHAPTER 3. SPECIFIC REQUIREMENTS

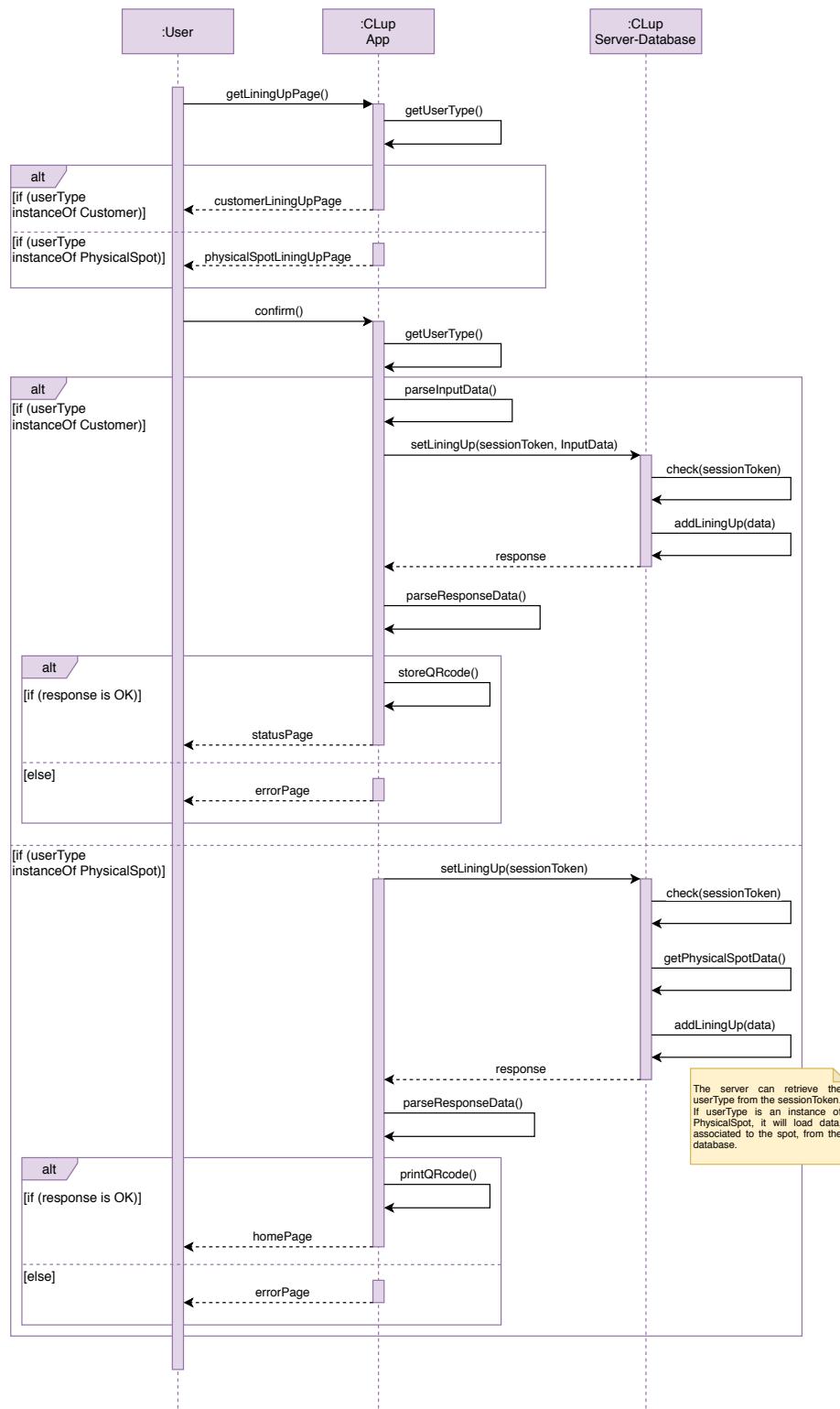


Figure 3.10: Lining Up sequence diagram.

CHAPTER 3. SPECIFIC REQUIREMENTS

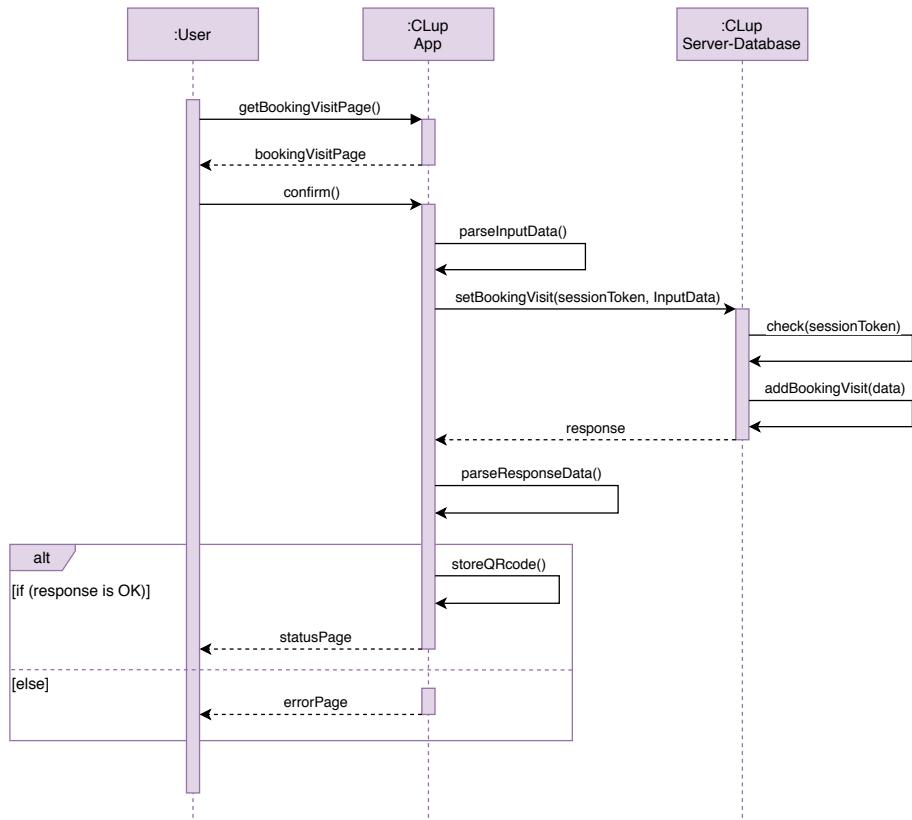


Figure 3.11: Booking a Visit sequence diagram.

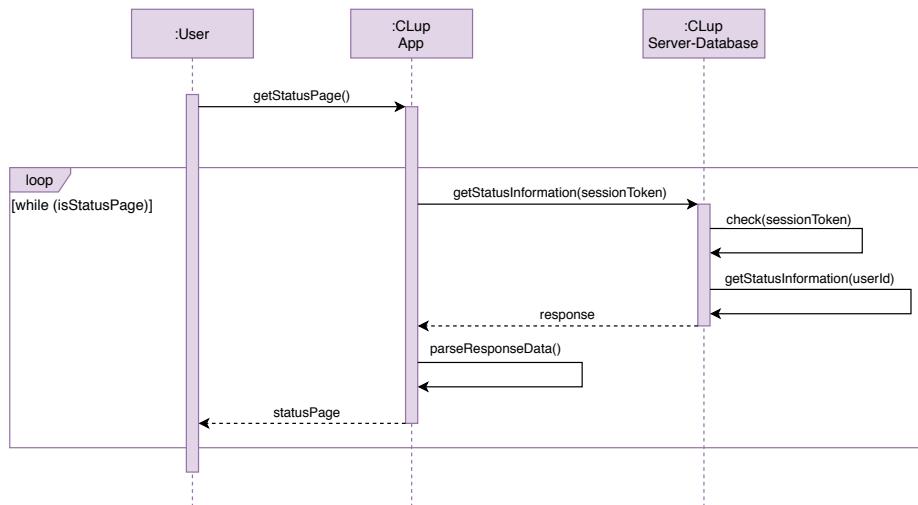


Figure 3.12: Get Status sequence diagram.

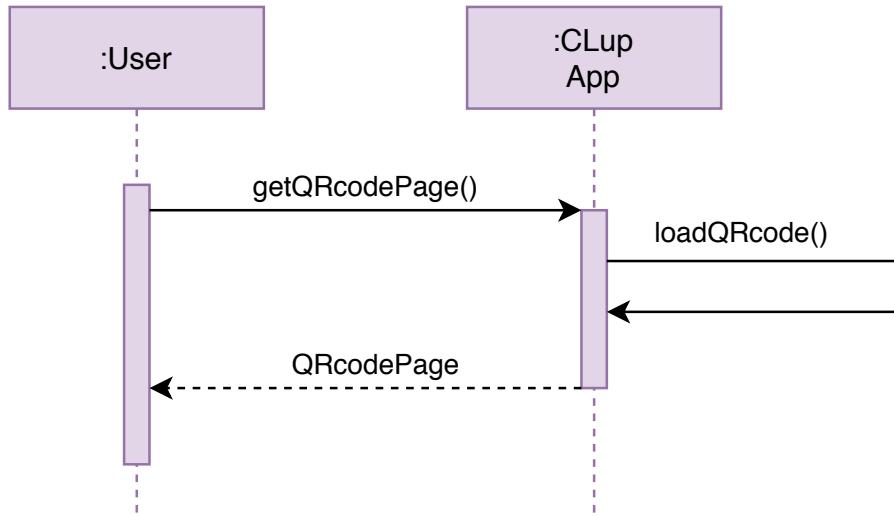


Figure 3.13: QR code page sequence diagram.

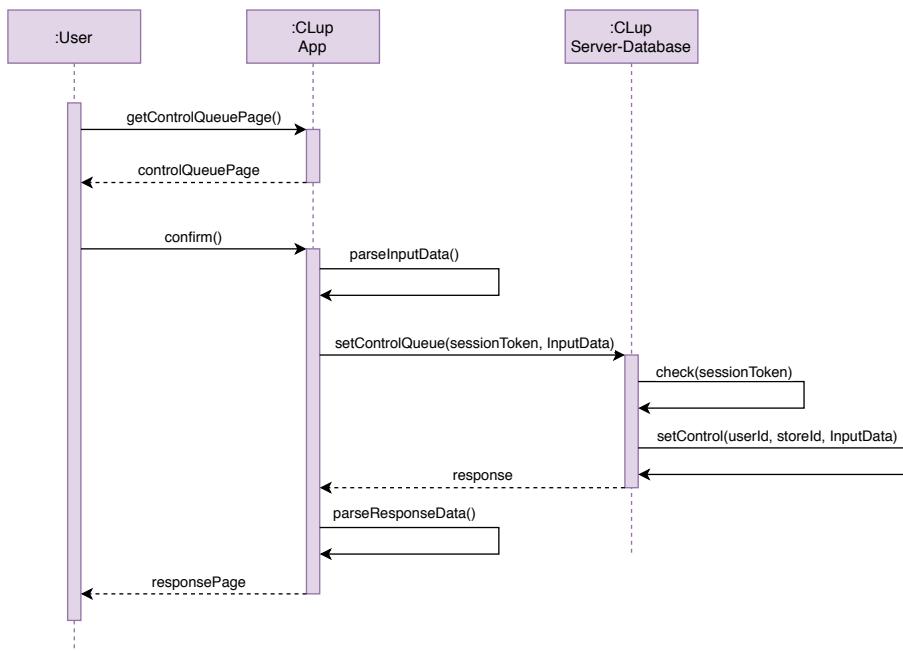


Figure 3.14: Control Queue sequence diagram.

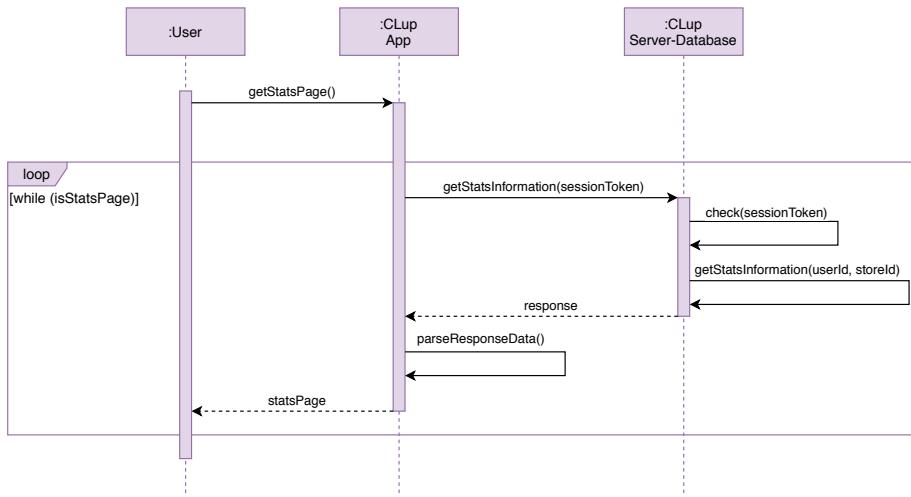


Figure 3.15: Show Stats sequence diagram.

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