



# POLITECNICO

## MILANO 1863

**DD**

Design Document

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# 1 INTRODUCTION

## 1.1 Purpose

The purpose of the project CLup (CustomerLine-up) is to develop a digital system of lining up that saves people from having to stand outside of stores for hours, avoids crowds inside the store, and, more in general, allows to regulate the influx of people in the stores.

The idea is to create a digital version of the traditional mechanism of lining up that is easy to use by everyone. In this way, the system would help to deal with the strict rules imposed by the government due to the global pandemic.

The system should give customers the possibility to line up from their home and approach to store only when their number is close to being called. This mechanism should avoid the situation in which the customers wait for their shift in the proximity of the store that is not an acceptable scenario in a lockdown situation.

## 1.2 Scope

The software should represent a digital alternative to the situation in which people retrieve a physical number that gives their position in the queue when they want to enter a store.

CLup should provide three main features:

- **Lining up:** allows customers to line up from their homes and avoids crowds outside the stores. It should include a notification system that alerts people when their number is close to being called. These alerts should consider the time customers need to get to the shop from the place they currently are and should be based on precise estimation of the waiting time. Moreover, CLup must provide effective fallback options for people who do not have access to the required technology.
- **Booking:** allows customers to book a visit to the supermarket. Since the time that it takes to visit a supermarket is not uniform, the system should give to user the possibility to specify an estimation of the duration of the visit. Alternatively, it might infer this information analysing the previous visits, if any.
- **Suggestion:** suggests different time slots for visiting the store (also on different days) to deal better with the restriction in the number of people inside the store. Alternatively, the system should propose other available supermarkets to the customers and alerts them in case a new time slot becomes available (e.g. after the deleting of a booking by another customer).

The customer that wants to use the service must be registered. Thanks to this, the system would be able to track the lining up, the booking, and the duration of the previous visits and use this information to manage better the influx of people and estimates with acceptable accuracy the waiting time.

## 1.3 Definitions, Acronyms, Abbreviations

### 1.3.1 Definitions

<b>Time slot</b>	Period or day that can be chosen for a booking by the customers.
<b>Store data</b>	Data about the store like the number of people allowed, opening and closing times, address, name, and photo.
<b>Reservation</b>	A word that might indicate either a booking or a lining up in a specific store.
<b>Active reservation</b>	Lining up or booking that is not yet expired. It means that the reservation has been taken but customers still have to wait for their shift.
<b>Store manager</b>	Manager, cashier, or generic employee of a store.
<b>Available shop</b>	A shop that has at least one free time slot.

### 1.3.2 Acronyms

<b>CLup</b>	Customer Line-up
<b>RASD</b>	Requirements Analysis and Specification Document
<b>SSL</b>	Secure Sockets Layer
<b>TLS</b>	Transport Layer Security
<b>UI</b>	User interface

### 1.3.3 Abbreviations

<b>W.n</b>	World phenomena n-th
<b>S.n</b>	Shared phenomena n-th
<b>G.n</b>	Goal n-th
<b>R.n</b>	Requirement n-th
<b>U.n</b>	Use cases n-th

## 1.4 Revision history

DATE	DESCRIPTION
29/12/2020	First version. Mock-ups and their descriptions.
02/01/2021	Architectural Design: Overview and Component View

## 1.5 Reference Documents

- *Requirement Engineering and Design Project: goal, schedule, and rules*
- *I&T assignment goal, schedule, and rules*
- Slides of the course *Software Engineering 2*

## 1.6 Document Structure

The document is composed of the seven following chapters:

- **Chapter 1:** provides an introduction to the purposes and the whole scenario of the software as already specified in the RASD document. First, it includes the general description of the system, then there is a sufficiently detailed specification of the main features that the system should provide. Lastly, it includes the list of abbreviations, acronyms, and definitions used in the document, the revision history, and the reference documents.
- **Chapter 2:**
- **Chapter 3:** includes some extensions and more details about the *User Interface* (UI) with respect to what was specified in the RASD document. In this section, several new mock-ups and their descriptions are included.
- **Chapter 4:**

- **Chapter 5:**
- **Chapter 6:** shows the amount of time that each member has spent to produce the document.
- **Chapter 7:** specifies the reference documents and online resources used during the production of this document.

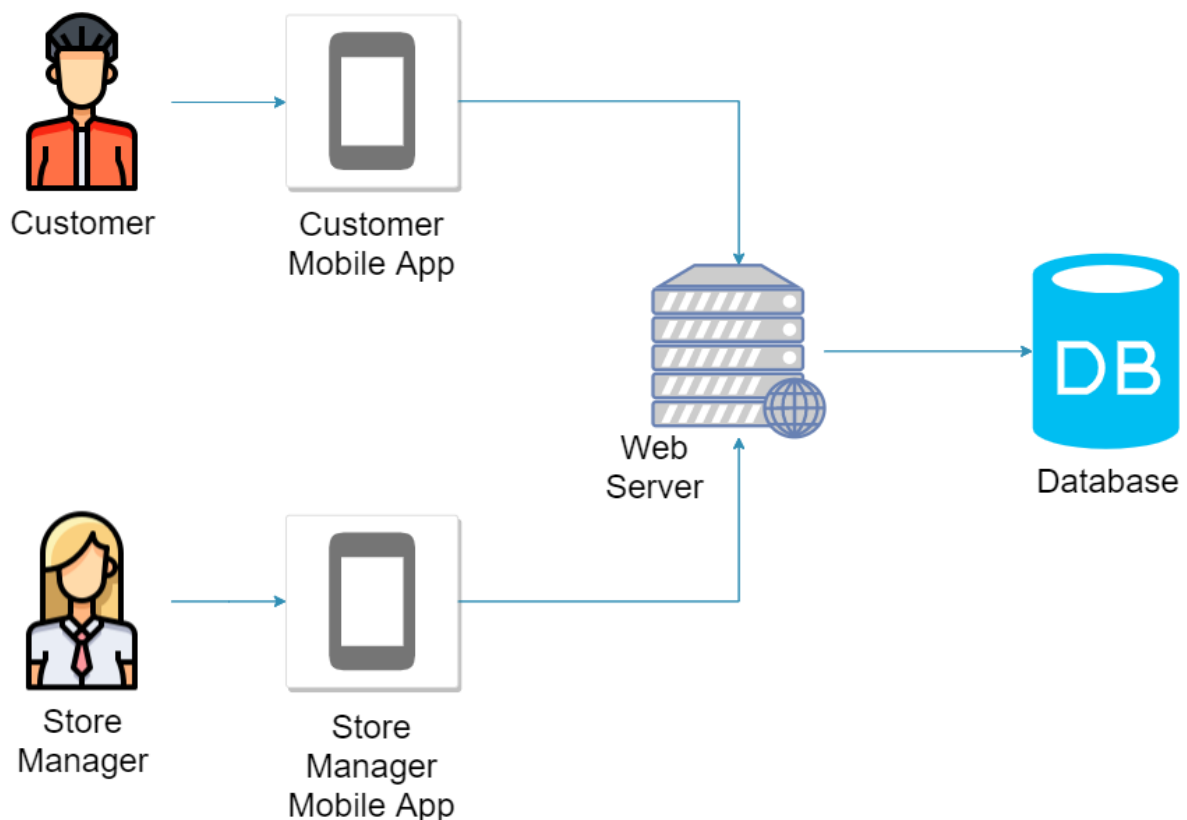
## 2 ARCHITECTURAL DESIGN

### 2.1 Overview

From a high level point of view, a three-tier architecture appears as a good choice for the purposes of the system. This is a well-know architecture organized in three logical and physical tiers:

- **Presentation tier:** it allows the interaction with the users providing the UI and the needed communication layers. It is able both to show and acquire information from the users that use the system.
- **Application tier:** it is able to modify, add or delete the data in the data tier. Here, using some defined business rules, it also processes the information from the presentation tier. It controls the application's functionalities, and it is also known as logic tier or middle tier.
- **Data tier:** here the data are stored and managed including the data persistence mechanism. It is also known as database tier, data access tier or back-end.

All communications between presentation and data tiers are possible only using the application tier.



*Figure 1: System Architecture*

This architecture offers several advantages like the logical and physical separation of functionalities. Moreover, each tier is executed on a dedicated operating system and platform on a dedicated virtual and hardware component. Other strengths are:

- reduction of the developing time thanks to the independence of each tier with respect to the others;

- high scalability: it is possible to scale each tier independently to the others;
- high reliability: it is unlikely that an eventual failure on a specific tier has an impact on the others;
- high security: the separation of the tiers makes less likely malicious attacks like SQL injections. In particular, the presentation tier and data tier cannot communicate directly.



## 2.2 Component view

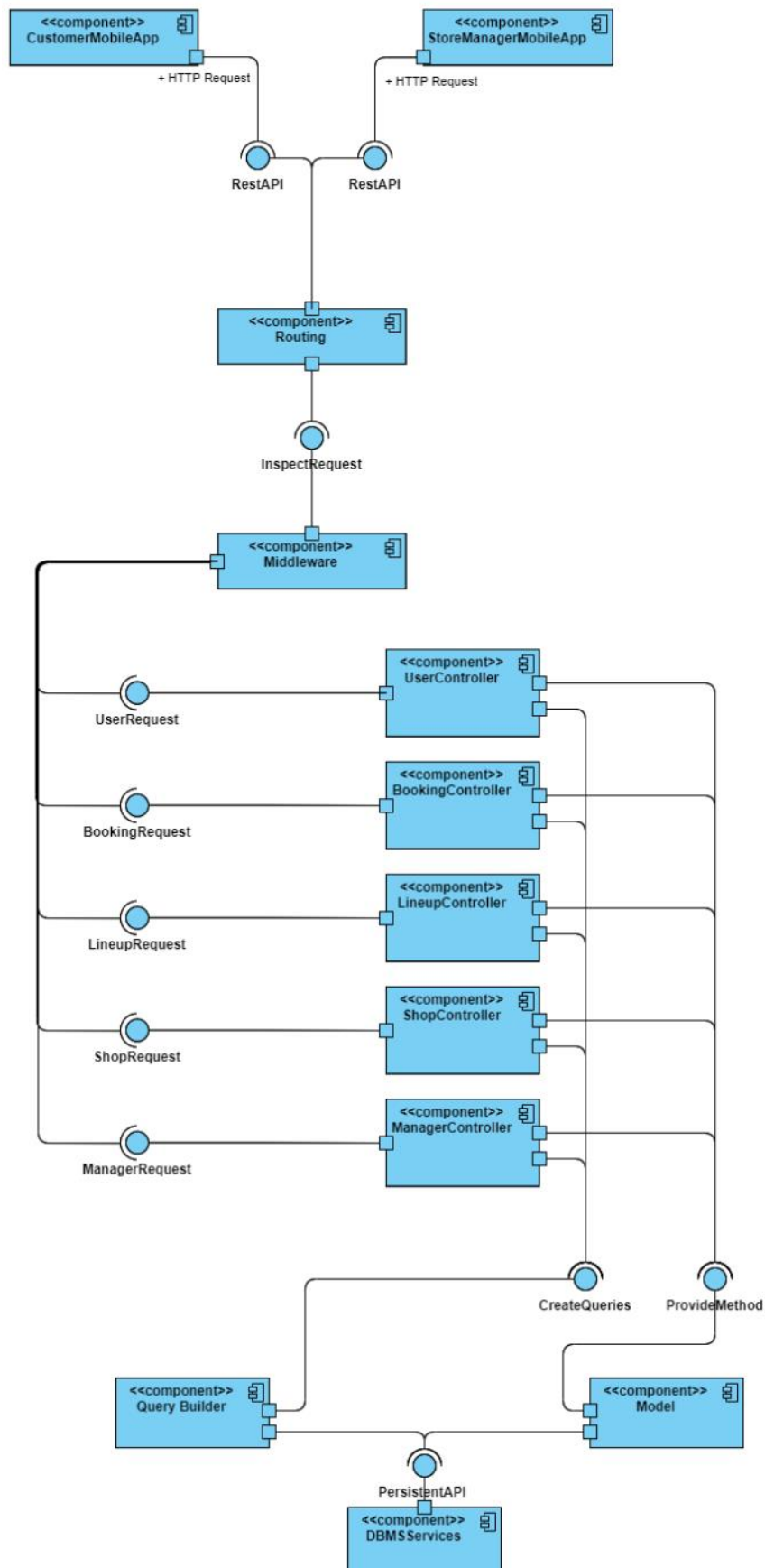


Figure 2: Component Diagram

The Component Diagram represents the internal structure of the system describing the main components and links between them. It shows also how some components are wired together to create larger components. The depicted components are:

- **Customer Mobile App**: mobile application used by the customer to access the system and its functionalities.
- **Store Manager Mobile App**: mobile application used by the store manager to access the system and its functionalities.
- **Routing**: this component loads the route files dispatching an HTTP request to a route, a controller, or executing the necessary middlewares.
- **Middleware**: filters and examines the requests according to the specifications of the component. Particular attention was paid to the authentication middleware that checks if the users that use the application are correctly authenticated. If they are so, their request can proceed; otherwise, the request is redirected.
- **UserController**: defines customer requests. For instance, it provides the method for the customer login that checks mail and password and, if they are correct, creates a unique token. This token authorizes the user to request further operations.
- **BookingController**: defines requests that create, update, and delete a booking.
- **LineupController**: defines requests that create, update, and delete a lining up.
- **ShopController**: defines shop requests. **It permits to query all available shops.**
- **ManagerController**: defines store manager requests. It allows the store manager to log in to the system and to check the QR code provided by the customer in order to approve the entrance into the store.
- **Query Builder**: this component allows to create and run queries communicating with the DBMSServices. As specified in the Laravel documentation, it includes a protection mechanism from SQL injection attacks that guarantees a high level of security.
- **Model**: provides methods to access and manage data. It is used by the controller.
- **DBMSServices**: manages the creation, manipulation, and querying of the database.

## 2.3 Deployment view

## 2.4 Runtime view

## 2.5 Component interfaces

## 2.6 Selected architectural styles and patterns

## 2.7 Other design decisions

### 3 USER INTERFACE DESIGN

In this section of the document, it is provided an overview of how the *User Interface* (UI) of the system will look like. Let us assume that the application is divided into several pages dedicated to the different main functionalities and that there are two versions of the application. One version is dedicated to the customers, while the other one is focused on the store manager. The following images show an idea of these pages.

#### 3.1 Mock-up Customer Application



Figure 3: Customer Initial Page mock-up



Figure 4: Customer Login Page mock-up

Figure 1 represents the page that CLup shows to customers during their very first access. On this page, they are able to reach the Login Page if they are already registered to the platform or create a new account if it is the first time that they use the software.

Figure 2 illustrates the page that allows customers to insert their credentials and then access the functionality of CLup. The required credentials are the email and the password set during the Sign Up process.



Name

Insert here your name

Email

Insert here your email address

Password

Insert here your password

Repeat Password

Insert here your password again

SUBMIT

Figure 5: Customer Sign Up Page mock-up

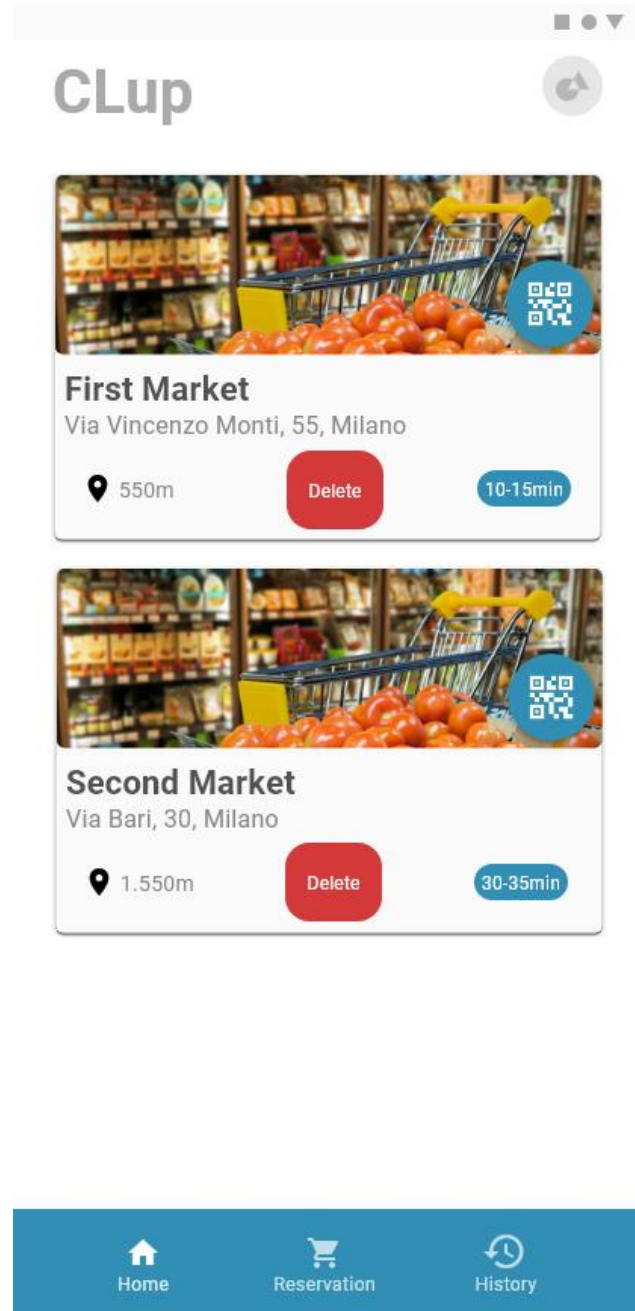


Figure 6: Customer Home Page mock-up

As anticipated before, customers can also submit their data and create a new account that allows access to the platform. The user profile is used to associate to each user the list of reservations (both active and non-active) and the duration of the previous visits to the stores used to improve the automatic estimation of the waiting time. An idea of the dedicated page is provided in Figure 3.

Due to the focus on privacy, the required data are only the essential ones. They are:

- Name
- Email
- Password
- Confirm password (to prevent typing mistakes)

Moreover, *Figure 4* depicts a mock-up of the Home Page of the application. It contains the main features like the list of active reservations with the possibility to delete them or to see the expected waiting time and some data about the shops. Furthermore, on this page, customers can open and use the QR code associated with each reservation.

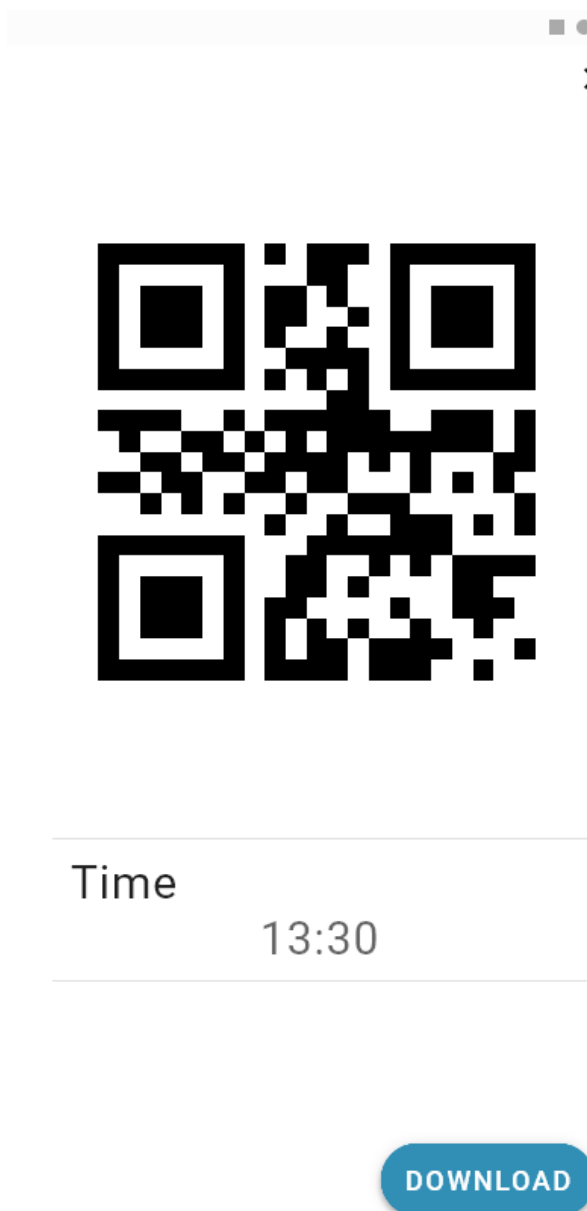


Figure 7: Customer QR Page mock-up

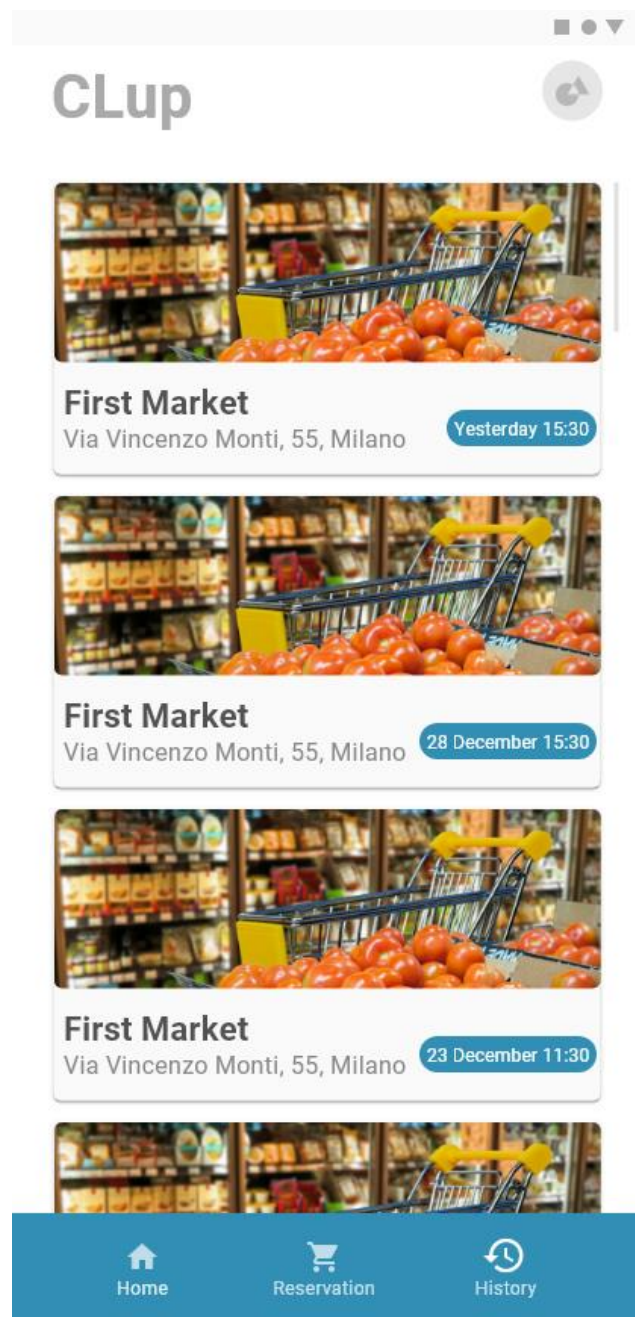


Figure 8: Customer History Page mock-up

On the left (*Figure 5*) a sketch of the page that shows the QR code associated with each reservation. Thanks to this page, the customers can scan their code when they enter and exit the store as expected. Here, it is provided also an indication of the expected waiting time or the expected time slot. Moreover, as specified during the phase of requirements definition, specific functionality is provided to allow downloading the QR code in the PDF format to make easier the printout.

On the right (*Figure 6*) it is shown a possible design of the History Page. Here, customers can access information about expired reservations with the indication of the shop (and its general data), the date and time of the reservation.

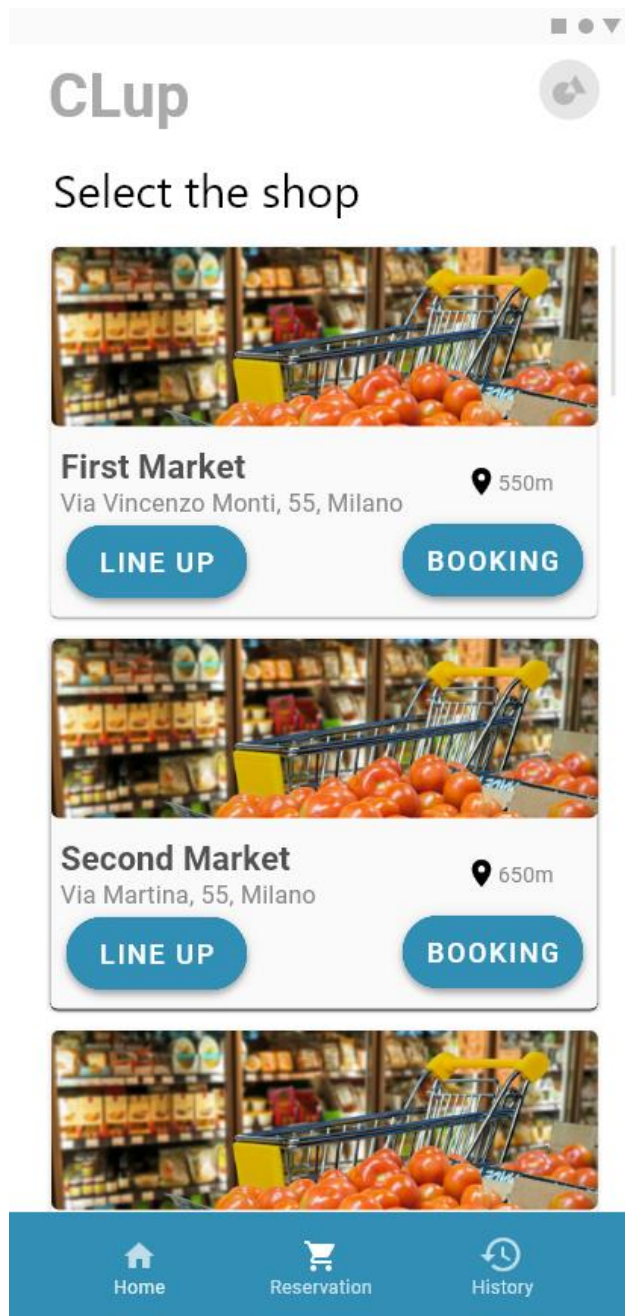


Figure 9: Customer Select Shop mock-up

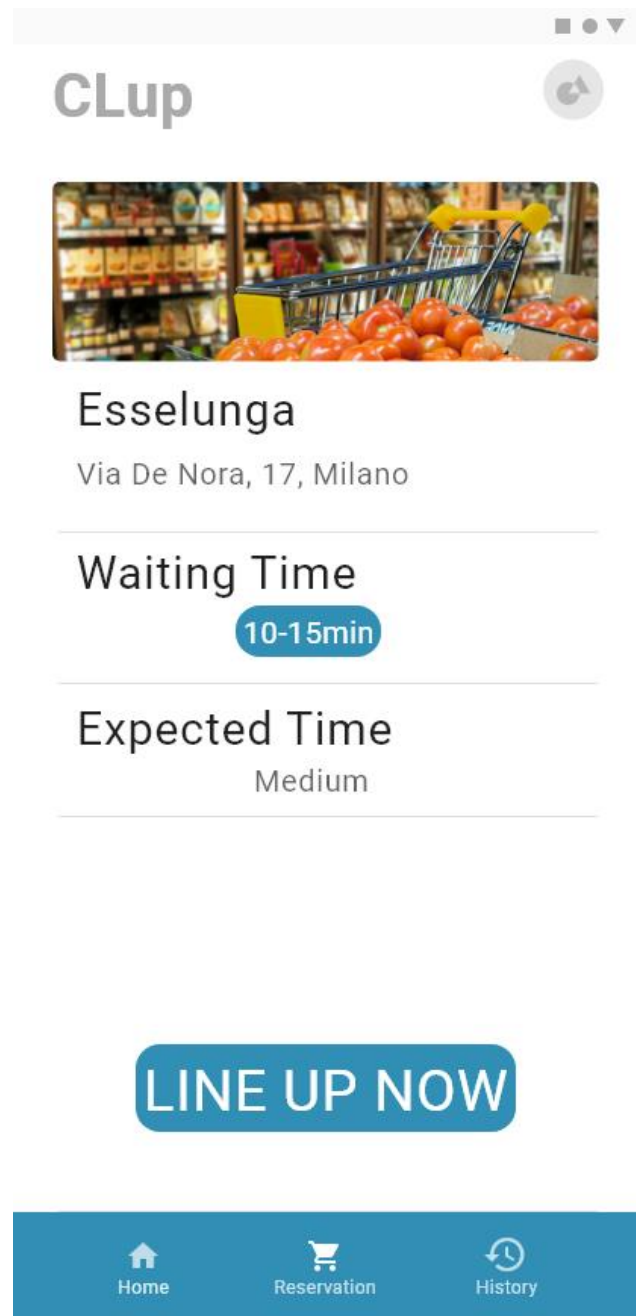


Figure 10: Customer Line Up Page mock-up

Figure 7 represents the Reservation Page that contains the list of active shops to permit customers to select the desired one. Each card of each store contains some information about the supermarket (e.g. position, photo) and the links to access lining up and booking functionalities.



Figure 8 shows the Line Up Page. Here, some information is provided like the name and position of the store and the expected waiting time. Moreover, customers must specify an estimation of the duration of the visit that is used by the system to better infer the waiting time.

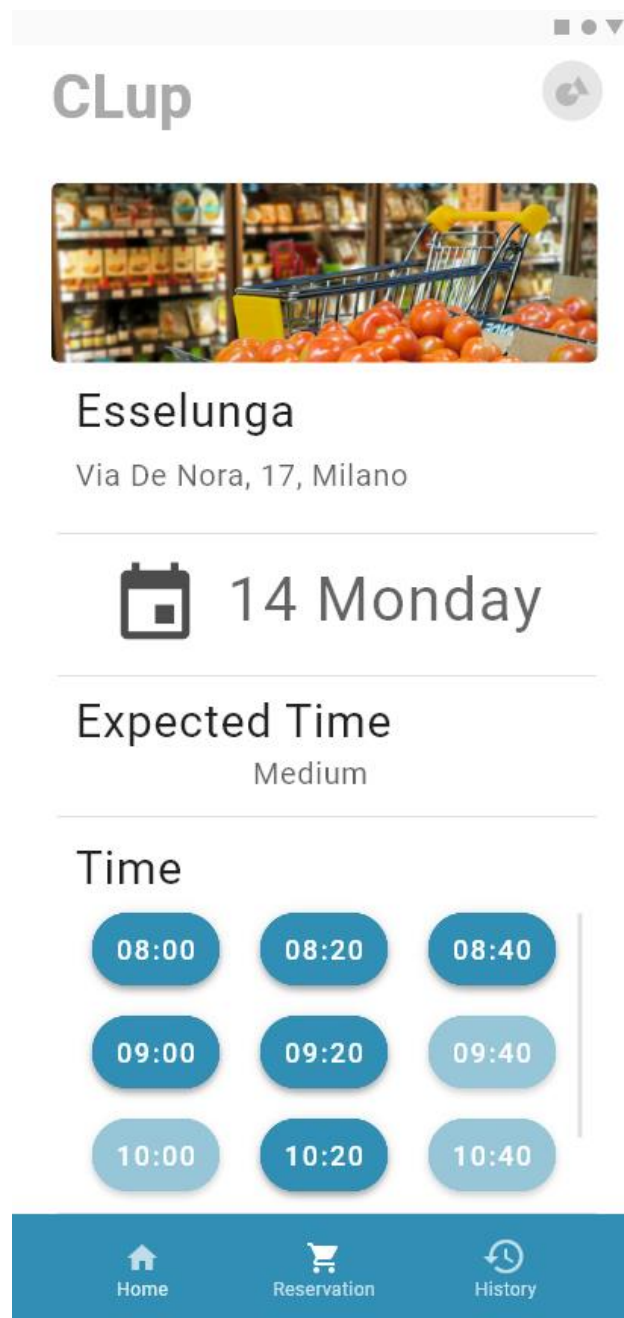


Figure 11: Customer Booking Page mock-up

Figure 9 gives a representation of how the Booking Page will look like. This page should contain the general data about the shop and allows to select the date and the time slot that is desired by the customer. Customers must also specify the expected duration of the visit.

### 3.2 Mock-up Store Manager Application



Figure 12: Store Manager Login Page mock-up

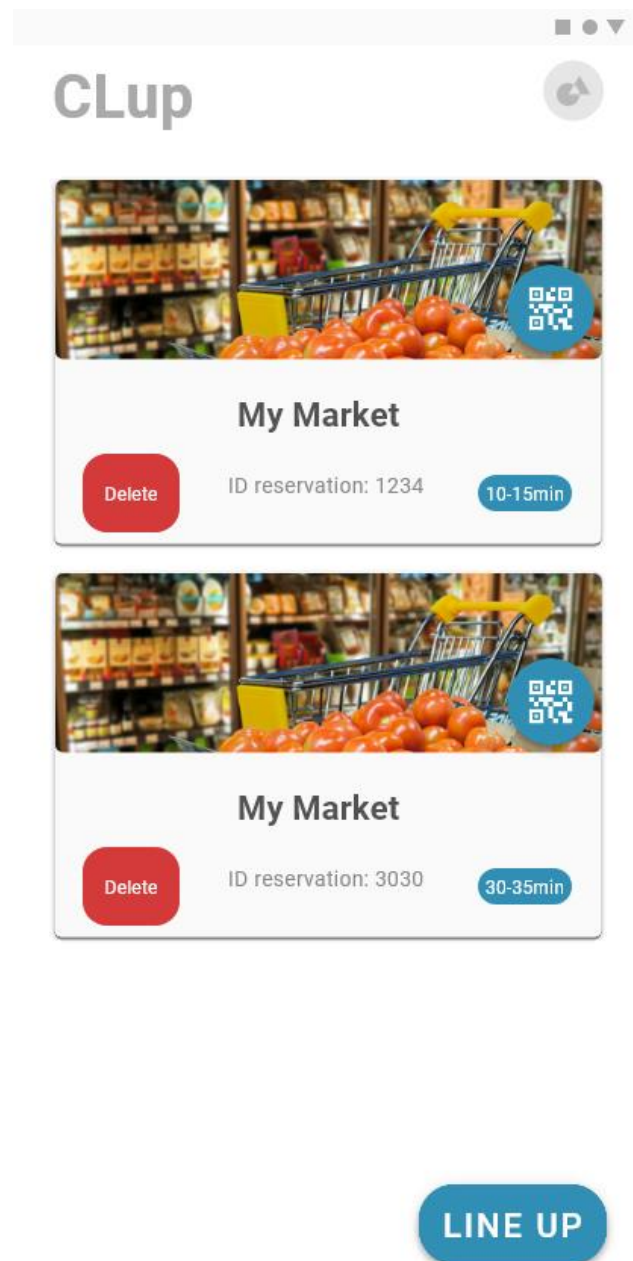


Figure 13: Store Manager Home Page mock-up

Figure 10 shows the version of the Login Page for Store Manager. In this case, the required credentials are the unique ID and the password.

On the other hand, Figure 11 depicts the Home Page of the application dedicated to store managers. This page contains some functionalities already seen in the version for customers like the possibility to delete a lining up and to check the expected waiting time. Moreover, in this version, the page contains also a direct link to the Line Up Page and an indication of the identifier of each reservation. This identifier is printed with the QR code and delivered to the customer and is used to associate each Line Up to each customer without requires her/his data (e.g. name). Lastly, on this page, store managers can open and print the QR code associated with each lining up.



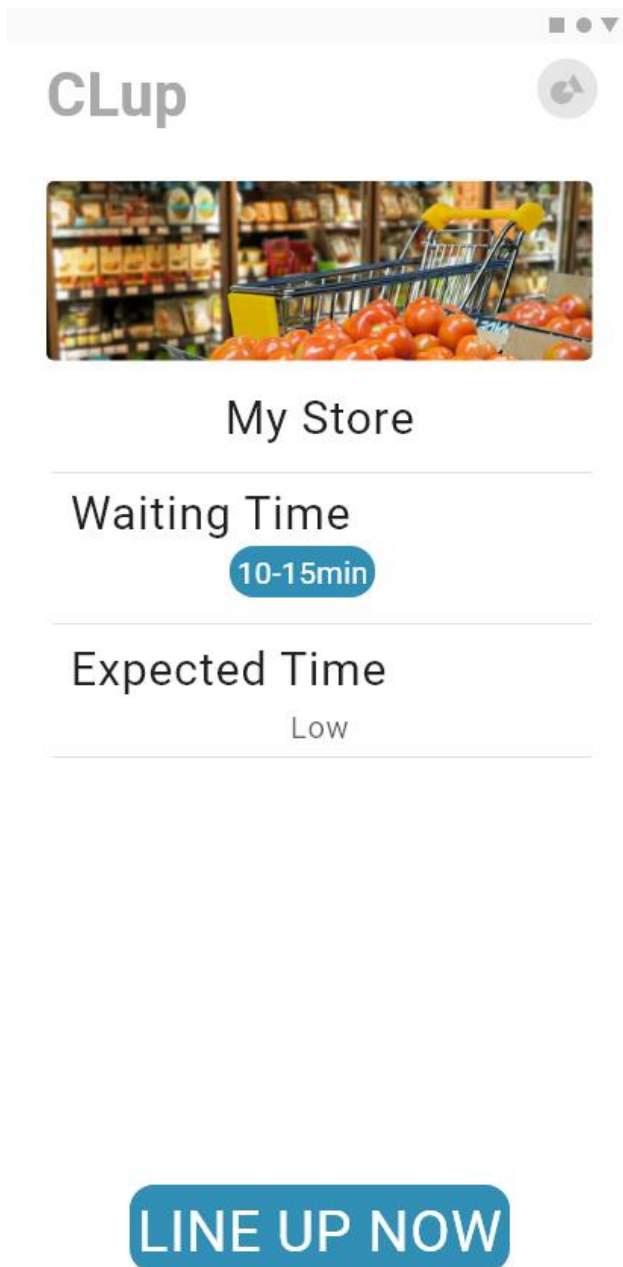


Figure 14: Store Manager Line Up Page mock-up

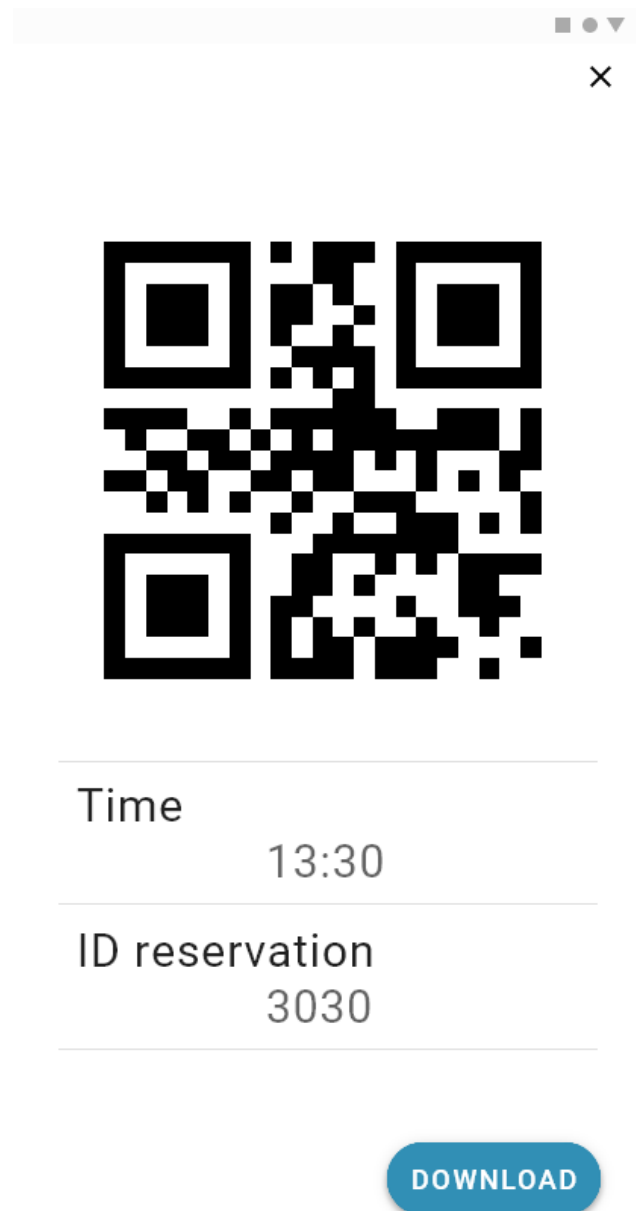
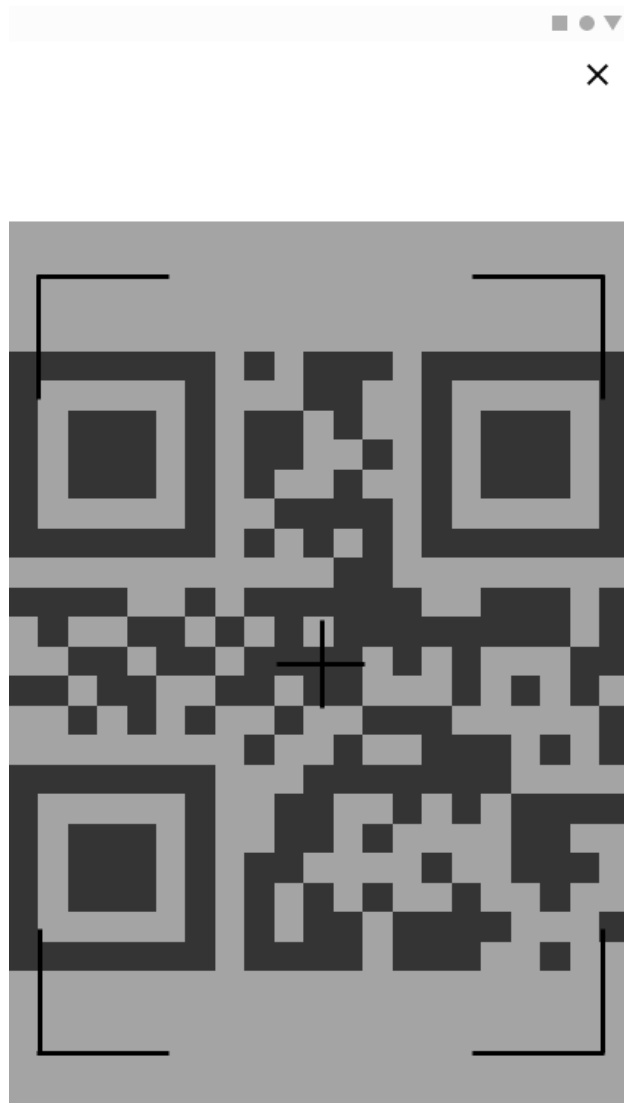


Figure 15: Store Manager QR Page mock-up

On the left (Figure 12) the Line Up Page. Here, the information about the waiting time is provided. Moreover, the page requires an estimation of the duration of the visit that is used by the system to better infer the waiting time.

On the right (Figure 13) an idea of the QR Page associated with each reservation. Thanks to this page, the store manager can provide the customer with an indication of the ID reservation and the estimated time. Furthermore, it is given the possibility to download the QR code in PDF format to make easier the printout.



*Figure 16: Store Manager QR Scanner Page mock-up*

*Figure 14* represents a possible UI of the QR code scanner. The store manager can scan the QR code shown by the customer to authorize the entering to or the exit from the store.

## **4 REQUIREMENTS TRACEABILITY**

### **4.1 xxx**

## **5 IMPLEMENTATION, INTEGRATION AND TEST PLAN**

## 6 EFFORT SPENT

This section shows the amount of time that each member has spent to produce the document. Please notice that each section, diagram, and specification is the result of coordinated work. The column *Member* specifies only the main contributor (or contributors, if more than one) for each topic but should not be interpreted as a lack of participation by other team members for that topic.

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## 7 REFERENCES

- The diagrams have been made with: <https://www.visual-paradigm.com/> and <https://lucid.co/it>
- The mockups have been made with: Adobe XD
- Alloy Language Reference: <https://alloytools.org/download/alloy-language-reference.pdf>
- Alloy Tools: <https://alloytools.org/tutorials/day-course/>
- Sequence Diagram Reference: <https://www.uml-diagrams.org/sequence-diagrams-reference.html>
- *UML - Imparare a descrivere sistemi orientati agli oggetti graficamente e in modo standard*, APOGEO, Enrico Amedeo
- <https://www.ibm.com/cloud/learn/three-tier-architecture>
- [https://en.wikipedia.org/wiki/Multitier\\_architecture](https://en.wikipedia.org/wiki/Multitier_architecture)