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Software Engineering 2 Project
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Customers Line-up

Requirements Analysis and Specifications Document

Version 0.0

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Contents

Chapter 1

Introduction

1.1 Purpose

The main scope of this document is to define requirements for the application development, in order to make a correct project planification. To do this, we will analyze:

- System;
- Functional and unfunctional requirements;
- Constraints;
- Relationships between stakeholders;
- Possible scenarios and tests;

These will be shown using different types of languages, starting from the natural language to the structured languages such as Alloy and UML. Below, we will define the context in which our application will be developed. During Sars-Cov-2 emergency, several countries imposed the lockdown in order to hinter the virus diffusion. People had to change their habits, in fact they could go out only for necessary needs, such as going to the supermarket or pharmacy. A lot of rules were introduced: not only using the masks or clean your hands but also keeping a social distance. For instance people must pay attention while they're entering in the market due to the long queue, which could increase the possibility of virus diffusion. This fact obliged people to stay for a long time standing up and waiting their turn losing a lots of time.

1.2 Scope

The aim of the project is to develop an application which, thanks to an intuitive interface, will avoid a long waiting outside the market. The application will provide a QR code as a virtual ticket on your own smartphone and to wait easily at home or everywhere instead of doing the physical queue for minutes or hours. In addition it will provide the position in queue and the time estimation of your turn. The system will generate a QR code for the authentication at the entry, in order to verify the position in the queue. Moreover, the application gives the possibility to ”book a visit” for who indicates the approximate expected duration of the visit and how many products they'll buy.

Although the reservation is made entirely with your smartphone, the market gives anyway the possibilities to provide the ticket locally on site, acting as proxies for the customers. This is mostly for aged people who are technologically backward or has no smartphone. Once this procedure is completed, a SMS will be sent to the customers for noticing their turn. [todo]

In order to achieve the goal, we define the World, Machine and Shared Phenomena, which are really crucial to describe the system. They're characterized by fact that the first and the second ones are not visible among them; so we need a link between them which i represented by the Shared phenomena.

1.2.1 World

It's the portion of system to be developed. The main *World Phenomena* are:

- Punctuality;
- Loss of connection;
- Respecting social distance;
- Shopping duration;
- Checking temperature;
- Respecting social distance;

1.2.2 Machine

It represents the portion of system to be developed. The main *Machine Phenomena* are:

- Average of shopping time;

1.2.3 Shared Phenomena

They're phenomena shared between the World and the Machine which are controlled or observed by the system. In this scenario mainly are:

- Book/delete a visit in the supermarket;
- Get a virtual ticket;
- Send a notice;
- Send a SMS;

1.3 Definitions, Acronyms, Abbreviations

1.3.1 Definitions

- *User*: individual who plan to shop in the market. He's registered in the market system with his personal data and he'll have its QRCode to enter in the market on his turn;
- *User non registered*: individual who plan to shop in the market. He's not registered in the market system, so he is not able to get his QRCode to stay virtually in the queue. So the store deals with managing his turn [TODO]
- *Booking*: it occurs when a User do the shopping. In addition Users can indicate the range of his purchases between *small, medium, large*, in order to allows the system having a better estimation of residence time;
- *Visit*: it occurs when a User do the shopping but, instead of the (simple) Visit, specifying more informations. In particular they have to specify the categories (or better the items) that are going to buy. Through this information the system can estimate the user's path due to (improving accuracy,) maximize the number of people allowed in the store;
- *Alternative booking*: reservations made by the users who are not able to book the visit with "the app". In this case [...];
- *Ticket Call*: it happens when the system allows n users entering in the market according to the order in the queue by calling their numbers;
- *Valid ticket*: the ticket is valid if and only if the system allows the user entering in the market;
- *Delayed ticket*: a ticket is delayed when, after the its ticket call, the user is not submit the QRCode in time (threshold of 1-2 minutes);
- *Cancelled ticket*: a ticket is cancelled when it's already delayed and passed too much time (threshold of 15-20 minutes);

- *BookingID*: string of n alphanumerical characters that is represented by the QRCode. If the user is not registered [...];
- *Mobilephone*: Elettronic device without CLup App;
- *Smartphone*: Elettronic devide with Clup App;

1.3.2 Acronyms

1.3.3 Abbreviations

1.4 Revision history

1.5 Reference Documents

1.6 Document Structure

G.1 Avoid to generate a long queue (Max 10 people) G.2 Grant the possibility of respecting social distance

Chapter 2

Overall Description

2.1 Product perspective

The aim is to build a system that manage the users'reservations and grants the possibility of booking the place in queue without wasting time while they're waiting their own turn outside the market.

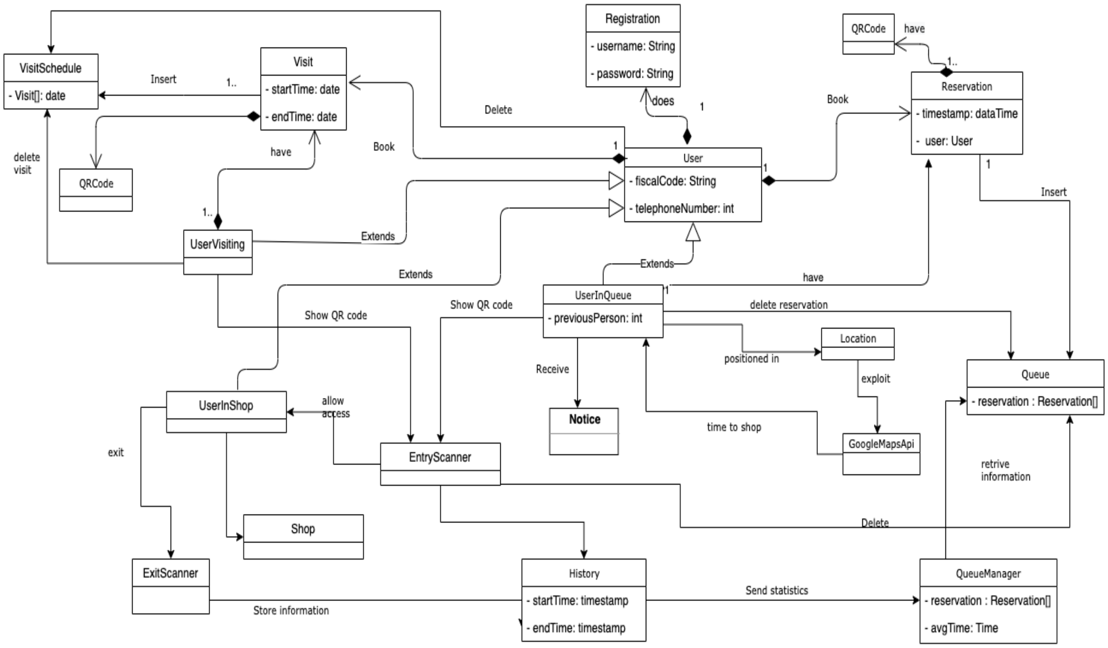
–The system have to provide User infomation about queue's dynamic in real time (i.e the number of people ahead and the time estimation before his own turn). – To do this, the application should try, in the best way, to estimate the time that the customers will spend in the shop, in order to notify in time users who are waiting their turn.
The application analyses the customers' statistics and computes the average shopping time. The calculation considers the time range between the moments in which the User goes in and out.

In this way, the customers in queue will be notified in time and will be able to use GoogleMaps APIs to compute the path for arriving in time to market. The choice of using Google Maps APIs derives from the easy usability, frequency update and very large documentation.

Moreover, it will be possible to book a visit choosing the date and time in advance (of some days?). In this case, users will also have to indicate an approximation of the shopping time.
The time will be splitted into 30 minutes slots, and customers will choose which they want among the free ones.

In the UML diagram below will be list the main classes in order to understand how the whole system works.

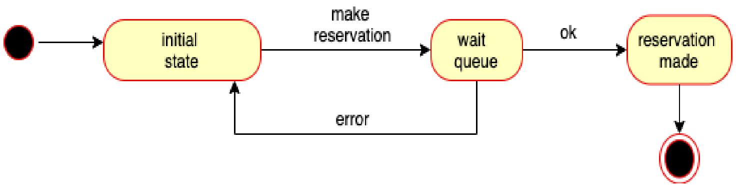
Figure 2.1: Class diagram with UML



As we can see from the class diagram in figure 3.11, the user can book once or a visit or a reservation. In both cases will be provide him a QRcode, which will be submit to enter in the market. If the the User decided to undo his reservation in the queue could do it by making a cancellation from the application.

Moreover, if the User allows to share his position, the system will notice him in advance due to his punctuality.
In addition the system will notice the User through an SMS or a notice when it's almost his turn (10-15 minutes before).
Now we will analyze the interaction between the User and the system, in order to understand possible criticities.

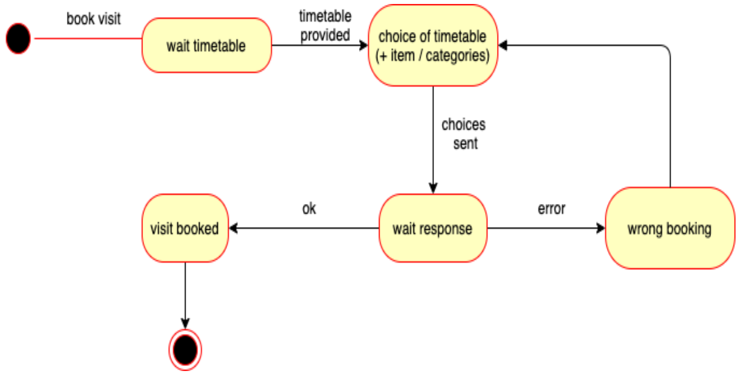
Figure 2.2: State diagram of the reservation in the queue



In the Figure 2.2 first state diagram it can be osserved how a generic User can

make a reservation thorugh the system. It's sufficient making this action to be added in queue to enter in the market.
If something goes wrong the User will be redirect to the home screen (initial state).
Usually the system reject the request if the market is next to closure (or for logistic problem).

Figure 2.3: State diagram of booking a visit



The Figure 2.3 explains instead how to book a visit in the market. Once the timetable is provided, the User have to select the range time of the visit and the items that he wants to purchase.

If the choice made by the user is wrong (i.e timetable's slot full), the system notify him; the User will try again until his choice is correct.

2.2 Product functions

2.2.1 Queue Manager

The most important function is the *Queue Manager* because it must avoid the users waiting too much time their turn due to a wrong use of notifications. [TODO] In fact, it have to foresee, through statistics from users' information, the correct time in which the users will enter in the market once arrived. This can be done thanks to the notifications sent to the user It will also have to understand when accept and when refuse reservations, according to shop closing time and the number of people in queue.

2.2.2 Data Collection

The *Data Collection* is essential for the correct behavior of the Queue Manager described previously, because it will have to provide precise dates according

to client's information. Therefore, the system will have to ask clients precise questions according to keep useful informations for estimating the shopping time into the supermarket, without violating users' privacy.
In order to achieve this goal, it needs to oblige the user to register himself in the system and to check the item to allow the processing of his personal data, necessary to reserve virtually the seat in the queue.
One of the possible information asked could be the dimension of the expenses, which can be estimate by the number of item that are going to be purchased. This will be used, with the entry time, to track the number of user inside the market who is finishing. Then will be possibile to notify in advance users in queue about the closeness of their turn.

2.3 User characteristics

We distinguish the actors into our application based on actions and interactions with the external world:

- *User*: he's a client who has signed in the system and he can book a visit or take his queue number.
- *UserInQueue*: he's a User who has taken his own turn in queue and he's waiting for the system notification
- *UserVisiting*: he's a User who has booked a visit and he's still waiting for entering into the supermarket.
- *UserInShop*: he's a client who has taken his own queue ticket or he has booked a visit. After that he is arrived at the supermarket, he has scanned the QR code and he has entered into the shop.

2.4 Assumptions, dependencies and constraints

Chapter 3

Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

The following mockups provide a model of graphic interface that will show our program.
We will create a user interface that will be user friendly in order to be easy to use also from non-technical users.
We list the following mockups that cover all application main aspects:

3.1.2 Hardware Interfaces

3.1.3 Software Interfaces

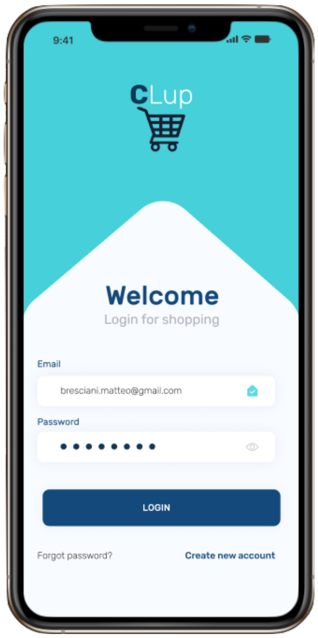
3.1.4 Communication Interfaces

3.2 Functional Requirements

Giovanna, a career woman who is always in trouble to find free time, needs to go grocery shopping for her family. Indeed, once she finished working, she goes to the market and, due to the lockdown, have to wait in line for hours to have access to it. The result is that, coming back home later, she can't put some time in her children. However, in the past days, she discovered CLup App which allows her to book a visit in the market in advance, by only putting the range time avaiable and the size of the expenditure. In this way, Giovanna will save a lot of time and will stay longer with her children, instead of waiting in line outside the market.

Nevertheless, due to Covid-19 emergency, the market will be always filled.

Figure 3.1: Login: Users already registered signes in with their credential.



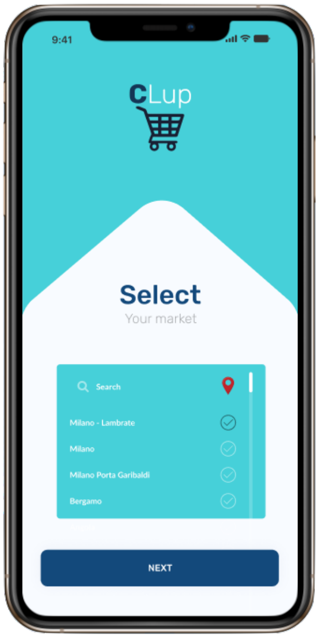
Email

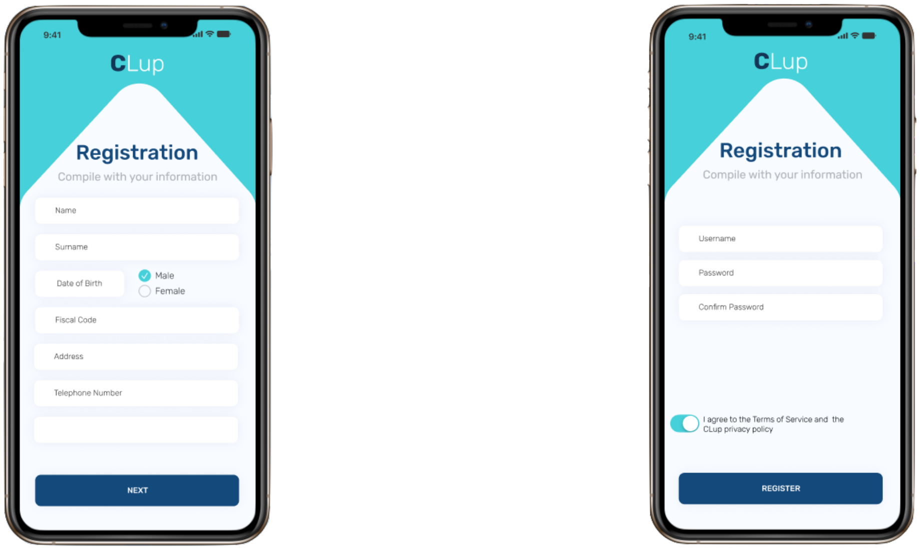
bresciani.matteo@gmail.com

Password

••••••••

Figure 3.2: Market selection: After the login, the user have to select in which market wants to go shopping, due to his position.



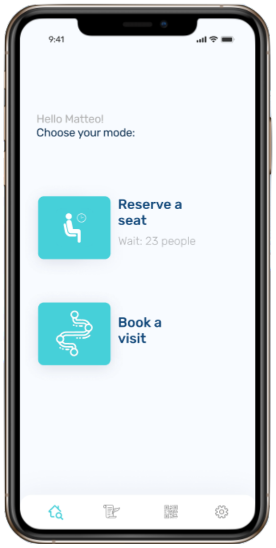


(a) Page 1.

(b) Page 2

Figure 3.3: Registration: Users not registered can register himself putting his own data, e-mail and password. In addition Users have to accepts the Term of Service and the CLup privacy policy to proceed.

Figure 3.4: Home: Homepage of CLup from which the USer can select to book a Visit or a Reservation.



Jonhathan, on the advice of his grandchild, bought a new smartphone. In addition started using it and installing usefull applications like CLup. In particular, with it, he'll be able to make a reservation in market's queue. In this way, CLup will notify him when, accordingly to his position, leave to get the market in time for his turn. Finally, once he arrived, can go in there by simply scanning the QRCode sent before. At the end Jonhathan will go shopping without waiting on feet his turn during a cold winter's day. Gustavo, an elderly person, he discovered recently a new time saver and usefull service at the market. It consists in booking a visit at the market by simply calling the number found in an advertisment. Due to the fact that Gustavo is sick of waiting too much in the queue, decides to call this market number to book the visit. On the other side Marta, a gentle receptionist who works for the market, answers to Gustavo's call; she takes care of the registration of his own data, the credentials and the all visit information (i.e data and range time).

Gustavo will be notified about the appointment with an SMS on his mobilephone in time. In addition the SMS will provide the schedule for the visit and the code which will be submitted at the entrance.

Use cases

Name	Login
Actor	User
Entry condition	• The user has register • The user opened the application
Events flow	• The user open the application • Enters username and password • Click “Login button”
Exit condition	User log in
Exceptions	• User enters wrong username • User enters wrong password

Name	Sign up
Actor	User
Entry condition	• User enters for the first time on the app • The user hasn't registered
Events flow	• The user selects "Create new account" option • The user enters required fields • The user accepts CLup privacy policy • The user clicks "Register" button
Exit condition	The users is registered
Exceptions	• The users has already been registered • The user did not accept CLup privacy policy • The user enters username that has already been used • The user enters prohibited characters

Name	Book a visit
Actor	User
Entry condition	• The user has logged in
Events flow	• The user click on Home Page • Click on "Book a visit" button • Select the visit date • Select the visit time • Insert shopping size • Click on "Next" button
Exit condition	The user book a visit
Exceptions	

Name	Take reservation
Actor	User
Entry condition	• The user has logged in
Events flow	• The user click on “Home Page” menù • Click on “Reserve a seat” button • Confirm the reservation
Exit condition	• The user has been queued • The QR code has been associated with user
Exceptions	The shop is closed

Name	Delete Visit
Actor	UserVisiting
Entry condition	• The user has logged in • The user took a visit
Events flow	• The user clicks on “QR code” menù • The visits and reservation are listed • The user clicks on “Delete” button near the visit • The user confirms the cancellation
Exit condition	• The system delete user visit • The system make available date and time of user visit
Exceptions	

Name	Delete reservation
Actor	UserInQueue
Entry condition	• The user has logged in • The user took a reservation
Events flow	• The user clicks on “QR code” menù • The visits and reservation are listed • The user clicks on “Delete” button near the reservation • The user confirms the cancellation
Exit condition	The system delete user reservation
Exceptions	

Name	Delay reservation
Actor	UserInQueue
Entry condition	• The user has logged in • The user took a reservation
Events flow	• The user clicks on “QR code” menù • The visits and reservation are listed • The user clicks on “Delay” button near the reservation • The user confirms the delay
Exit condition	• The user turn will be shift ten places after. • The delay button will be disabled.
Exceptions	• The user queue is too small • The user delay function has already been used

Name	Recap visit
Actor	User
Entry condition	The user has logged in
Events flow	The user click on “history” menù
Exit condition	The visits and reservation are listed
Exceptions	

Name	Visualize own turn
Actor	UserInQueue
Entry condition	• The user has logged in • The user took a reservation
Events flow	The user clicks on “history” menù
Exit condition	The system show the user turn near the reservation QR code
Exceptions	

Name	Update position
Actor	UserInQueue
Entry condition	• The user has logged in • The user took a reservation
Events flow	• The user clicks on “QR code” menù • The user clicks on “Update position”
Exit condition	The system calculate the number of customers in queue after which will send the message
Exceptions	• GPS position too far from supermarket • Invalid GPS position • GPS is inactive

Name	Choice market
Actor	User
Entry condition	User login for the first time on the app
Events flow	• Select the supermarket • Click “Next” to confirm
Exit condition	The system calculate the number of customers in queue after which will send the message
Exceptions	The user is linked to supermarket

3.2.1 Reception

Scenarios

Scenario 1

Gustavo, an elderly person, he discovered recently a new time saver and usefull service at the market.
It consists to book a visit at the market by simply calling the number found in an advertisment.
Due to the fact that Gustavo is sick of waiting too much in the queue decide to call this market number to book the visit.
On the other side Marta, a gentle receptionist who works for the market, answers to Gustavo's call; she takes care of the registration of his own data, the credentials and the all visit information (i.e data and range time).
Gustavo will be notified about the appointment with an SMS on his mobilephone in time.
In addition the SMS will provide the schedule for the visit and the code which will be submitted at the entrance.

Use cases

Name	Sign up user
Actor	Reception
Entry condition	• The receptionist has logged in • The user has not registered
Events flow	• The receptionist asks required information to do registration • The receptionist fills the fields • The receptionist confirms the registration
Exit condition	The user has registered
Exceptions	• The phone cuts out • The user has already registered

Name	Delete user visit
Actor	Reception
Entry condition	• The receptionist has logged in • The user wants delete a visit
Events flow	• The receptionist asks user information • The receptionist asks visit information • The receptionist checks the visit on the menù • Delete user visit clicking “delete” button
Exit condition	The user visit is deleted
Exceptions	The user has not booked any visits

Name	Book user visit
Actor	Reception
Entry condition	• The receptionist has logged in • The user must be registered
Events flow	• The receptionist asks the credentials • The receptionist enters the credentials in the system to check registration • Click “select” button on user row • Click “book a visit” button • The receptionist check free slot and agree with user date and time • Enter date,start time, end time • The receptionist confirms the visit
Exit condition	The user book a visit
Exceptions	The phone cuts out

Name	Check user visit
Actor	Reception
Entry condition	• The receptionist has logged in • The user must be registered
Events flow	• The receptionist check user registration • The receptionist check user visits
Exit condition	The system list all user visits
Exceptions	• The user does not exist • The user has not booked any visits

Name	Check visit schedule
Actor	Reception
Entry condition	The receptionist has logged in
Events flow	• The receptionist click on calendar • The system lists all free dates • The receptionist click on date
Exit condition	The system lists all date free slot
Exceptions	

Name	Check system queue
Actor	Reception
Entry condition	The receptionist has logged in
Events flow	The receptionist clicks on “Check queue”
Exit condition	The system lists all user in queue information
Exceptions	The queue is empty

Name	Take user reservation
Actor	Reception
Entry condition	• The receptionist has logged in • The user must be registered
Events flow	• The receptionist asks the credentials • The receptionist enters the credentials in the system to check registration • Click “select” button on user row • Click “reserve a sit” button • The receptionist confirms the reservation
Exit condition	The user has been queued
Exceptions	The queue is full

Name	Delete user reservation
Actor	Reception
Entry condition	• The receptionist has logged in • The user must be registered
Events flow	• The receptionist asks user information • The receptionist checks the reservation on the menù • Delete user reservation clicking “delete” button
Exit condition	The user reservation is deleted
Exceptions	The user has not booked any reservation

Name	Login reception account
Actor	Reception
Entry condition	The receptionist open desktop app
Events flow	• The receptionist enter the credentials to log in • Click on “Sign in” button
Exit condition	The receptionist has logged in
Exceptions	• Wrong password • Wrong username

3.3 Performance Requirements

3.4 Design Constraints

3.4.1 Standards compliance

Especially, the system will be released in the main digital distribution platform (such as App Store or Google Play). So it must follow their guidelines in order to have a proper and a lawful distribution. In addition, due to the fact that it retrives and analyses many sensitive data, application must respect tha main privacy guidance. In particular in Europe must follow the General Data Privacy Regulation (GDPR), due to a safe and aware processing of data.

3.4.2 Hardware limitations

- 2G/3G/4G/5G connection: they're essential due to server connection to compile booking request;
- GPS: it's used to allow user to estimate the time spending to reach the market in time. But it's not mandatory for booking;

3.4.3 Any other constraint

There are no other constraint.

3.5 Software System Attributes

3.5.1 Reliability

The application have to provide user the possibility to book both reservation and visit successfully. [TODO]

3.5.2 Availability

Due to the fact that nowadays grocery shopping is avaiable almost all day, the availability of the system is very high. So the required availability is close to 99%. However, the reservation function has a lower avaibility because of the inability to book a seat in queue if the market is closed in some hours of the day.

3.5.3 Security

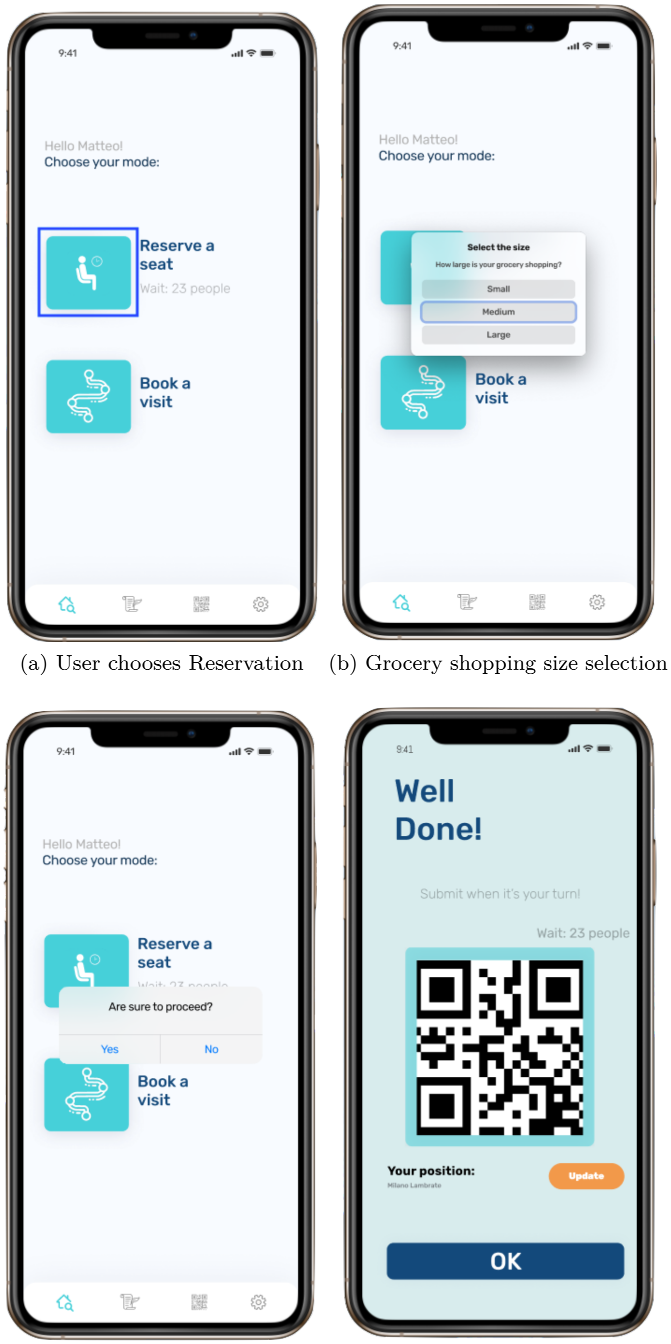
Security is one of the most critical aspect of CLup. So User's sensitive data are stored safely DBMS accessibile only by strict level of privilege. In addition, communication towards the application server (like login or booking requests) are implemented using HTTPS protocol, which, with TLS protocol, ensure the encryption of every packets.

3.5.4 Maintainability

The application implementation must be oriented towards an high scalability in order to gurantee an efficient and cheaper maintenance. This could be done by using design patterns.

3.5.5 Portability

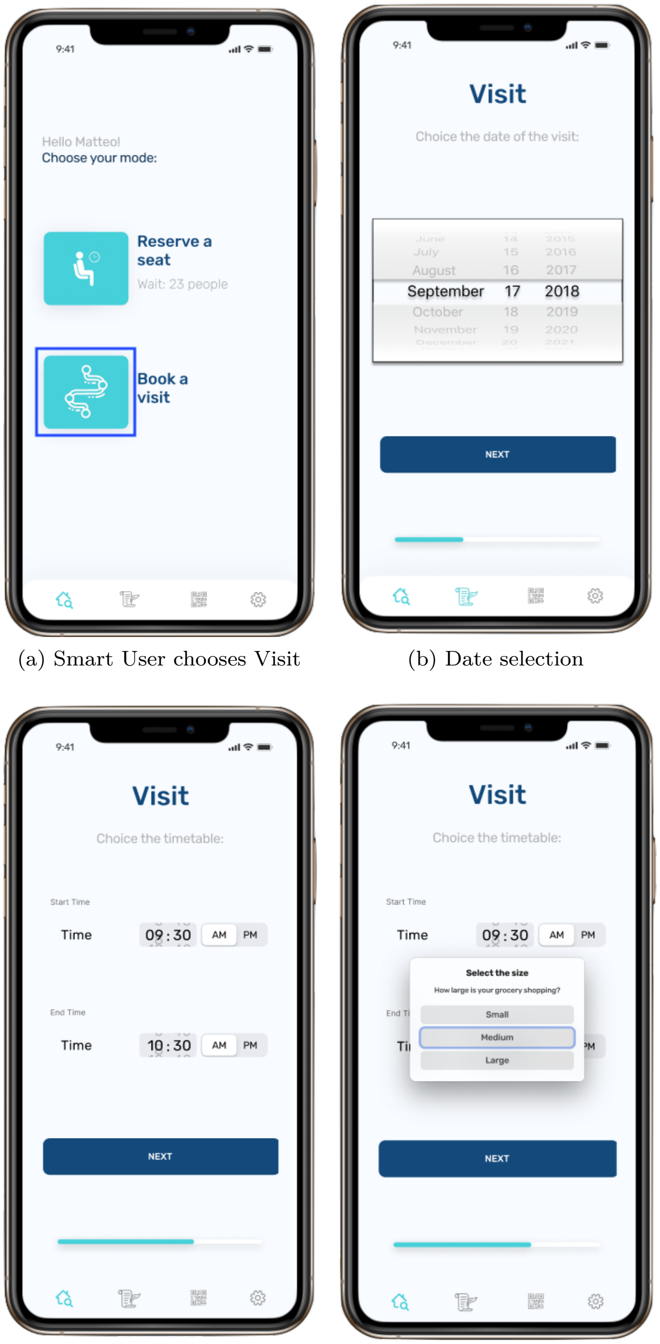
The system must be smoothly portable almost the main smartphone on the market. So CLup must be distributed for the main mobile operating system (i.e App Store and Google Play), coding it with program language such as Android or Swing. In addition CLup Guest, the application used by receptionist to book visit and reservation of the Users not register, must be compatible with the main Operating system such as Windows and Mac OS X. [todo]



(a) User chooses Reservation (b) Grocery shopping size selection

(c) Booking confirm (d) Reservation's QRCode is provided

Figure 3.5: Reservation: The Smart User can book a Reservation following the following steps.



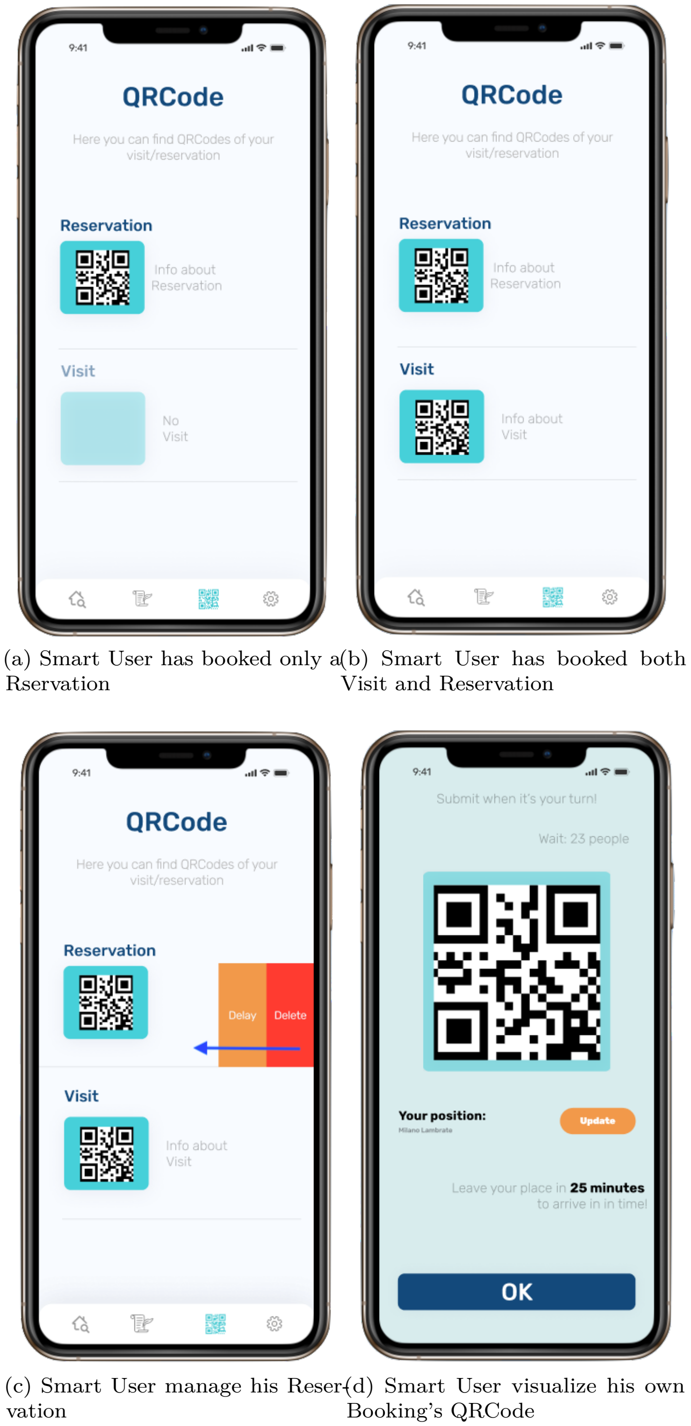
(a) Smart User chooses Visit

(b) Date selection

(c) Time period selection

(d) Grocery shopping size selection.

Figure 3.6: Visit: The Smart User can book a Visit following the following steps. At the end Visit's QRCode is provided.



9:41

QRCode

Here you can find QRCodes of your visit/reservation

Reservation

Info about Reservation

Visit

No Visit

(a) Smart User has booked only a Rservation

9:41

QRCode

Here you can find QRCodes of your visit/reservation

Reservation

Info about Reservation

Visit

Info about Visit

(b) Smart User has booked both Visit and Reservation

9:41

QRCode

Here you can find QRCodes of your visit/reservation

Reservation

Delay

Delete

Visit

Info about Visit

(c) Smart User manage his Reservation

9:41

Submit when it's your turn!

Wait: 23 people

Your position:

Milano Lambrate

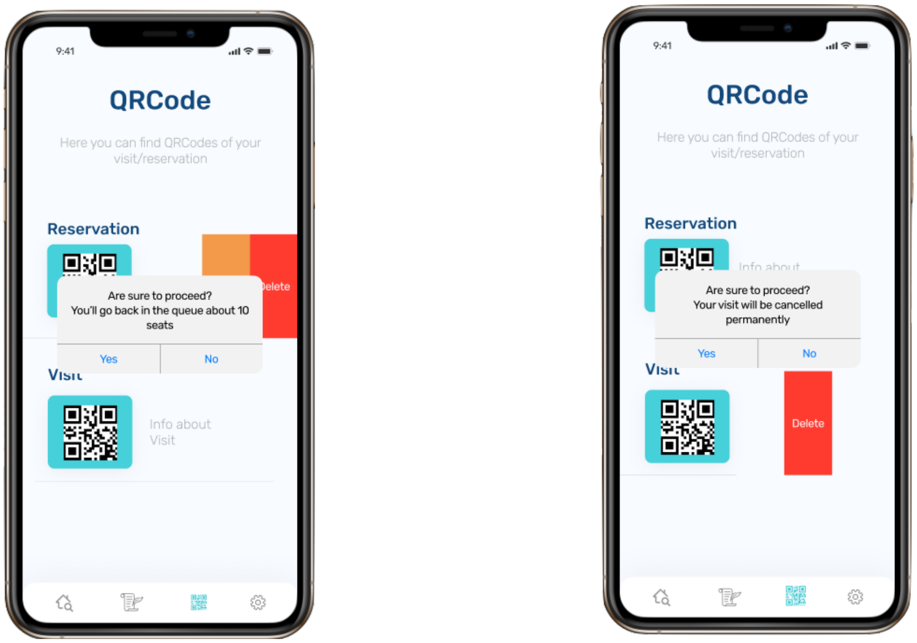
Update

Leave your place in **25 minutes** to arrive in in time!

OK

(d) Smart User visualize his own Booking's QRCode

Figure 3.7: QRCode section: in this section the user can manage his booking. A Smart User can cancel, delay (only for Reservation), or visualize his QRCode in order to access to the market.



Here you can find QRCodes of your visit/reservation

Are sure to proceed?
You'll go back in the queue about 10 seats

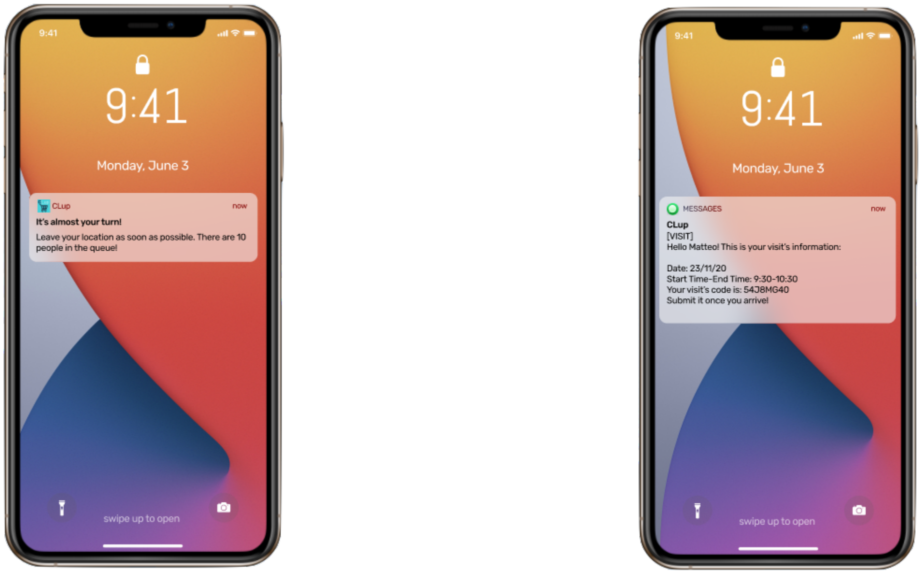
Here you can find QRCodes of your visit/reservation

Are sure to proceed?
Your visit will be cancelled permanently

(a) Delay confirmation of a Reservation

(b) Cancellation confirmation of a Visit

Figure 3.8: Cancel and Delay action: A alert will showed to Smart User to confirm his action.



CLup now

It's almost your turn!

Leave your location as soon as possible. There are 10 people in the queue!

MESSAGES now

CLup
[VISIT]
Hello Matteo! This is your visit's information:

Date: 23/11/20
Start Time-End Time: 9:30-10:30
Your visit's code is: 54J8MG40
Submit it once you arrive!

(a) A notification is sent to a Smart User to inform him to leave in order to reach the market in time.

(b) An SMS is sent to a Mobile User with booking information of his Visit. In particular contains the Booking's schedule and the Identification Code to submit.

Figure 3.9: Notifification and SMS: User receive his information about his Booking depending on whether is a Smart or Mobile User.

Figure 3.10: Use case USER

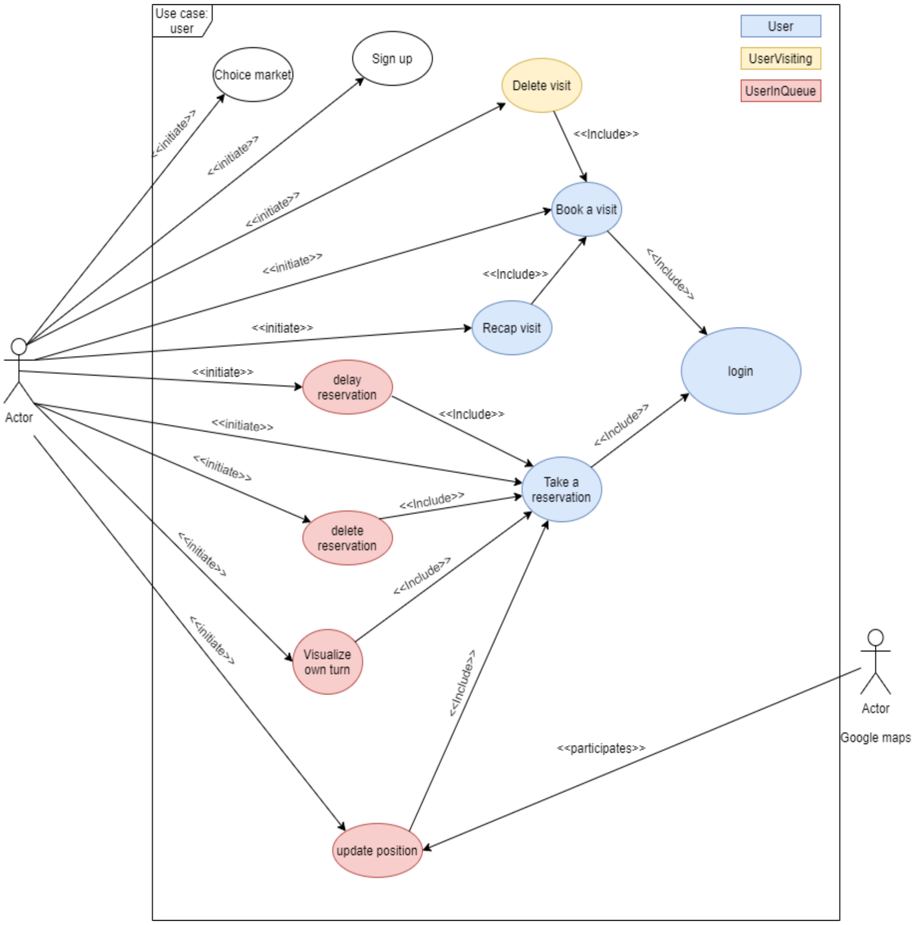
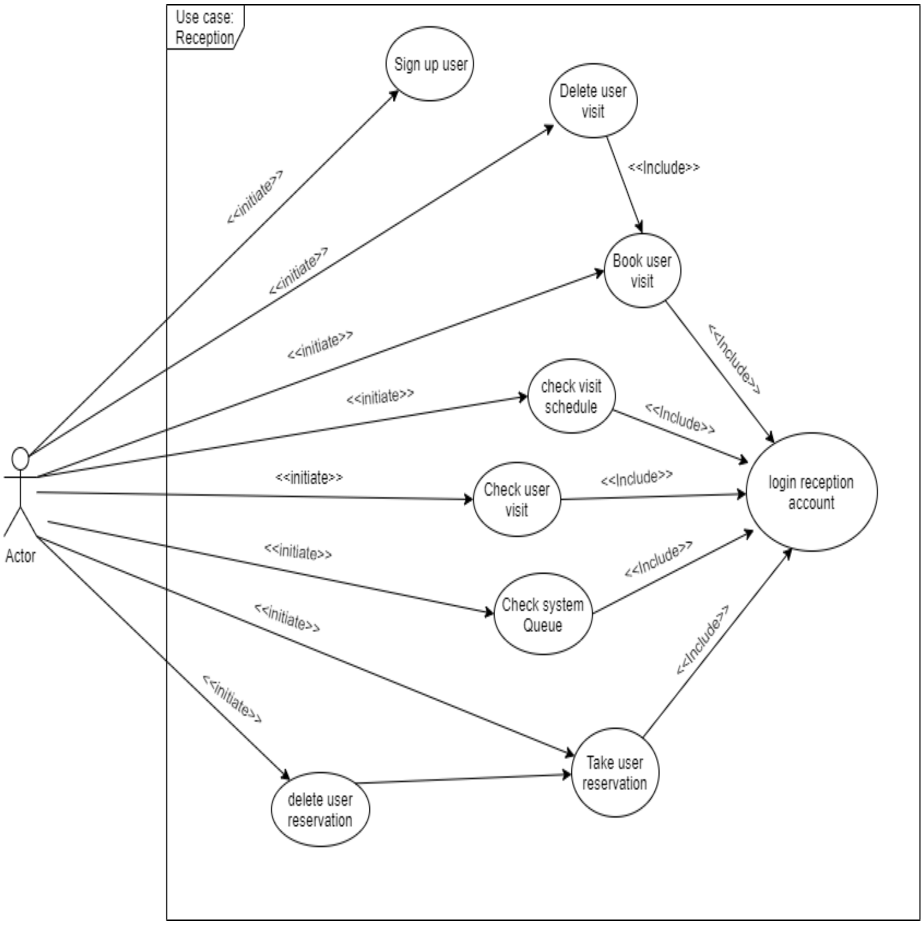


Figure 3.11: Use case RECEPTION



Chapter 4

Formal Analysis Using Alloy

Chapter 5

Effort Spent

Chapter 6

References