CLup - Customers Line-up

Requirements Analysis and Specification Document

1 Introduction

1.A Purpose

Customers Line-up is an application that allows users to make reservations for visiting a grocery store.
The idea arises in a context of sanitary emergency, in which people experience a lockdown situation and should be as safe as possible, in order to prevent the evolution of a pandemic and all its consequences on society. Of course, grocery shopping is an essential need, but all the activities connected to it must be highly regulated, so that crowds are avoided and safety is guaranteed.
A typical rule for supermarkets, in an epidemic situation, is to restrict access, in order for people to keep enough distance while doing the shopping. However, the immediate consequence of this measure is physical lining up, which is in turn a problem: crowds form and social distancing can become far from reality.
Customers Line-up is thought for avoiding this kind of situation, enabling a way to queue up virtually and prevent any sanitary risk: the influx of people inside the store is regulated, customers have interests in reserving a ticket (to enter) from their cars or homes, and rules to contrast the pandemic are respected on all sides.
To resume, the goals of the software system are those of granting social distance outside supermarkets, managing entrances and avoiding crows inside them. A list of the application's goals is presented here.

GOALS	
G1	Grant social distance outside the grocery store **G1.1**: Avoid physical lining up outside the grocery store*
G2	Manage entrances in the grocery store
G3	Avoid crowds (too many people) inside the grocery store (at the same time)

** G1's subgoal; from now on, references to this subgoal will be made using **G1.1** abbreviation*

1.B Scope

According to Michael Anthony Zackson and Pamela Zave's standard model for requirements engineering, this section proposes an overview of World and Shared phenomena connected to the environment where *Customers Line-up* is thought to work.

WORLD PHENOMENA	
WP1	A customer wants/needs to go to the grocery shop
WP2	A customer gets to (or approaches) the grocery shop by car/by bike/on foot/any other means of transportation
WP3	A customer inside the grocery shop decides to buy an item
WP4	A customer does the grocery shopping in a particular order
WP5	A customer pays at the check-out
WP6	

SHARED PHENOMENA - WORLD CONTROLLED	
SPW1	A customer gets a ticket
SPW2	A customer deletes his booked ticket
SPW3	A customer books a visit
SPW4	A customer deletes his booked visit
SWP5	A customer exits from the grocery shop
SWP6	A time slot is available for a reservation
SPW7	A customer gets a ticket/books a visit, but does not go to the grocery shop
SPW8	A customer gets a ticket/books a visit, but arrives at the grocery shop too late (after his turn and the associated time limit to enter)

SHARED PHENOMENA - MACHINE CONTROLLED	
SPM1	A customer enters in the grocery shop
SPM2	A customer is notified for entrance

SPM3	A customer is notified to leave from home
SPM4	A customer receives a notification suggesting to book a visit in his habitual grocery shop, day of the week and hour
SPM5	After a failure in the attempt to reserve a visit (due to time slots unavailability), a customer receives a suggestion to book in a different grocery shop
SPM6	After a failure in the attempt to reserve a visit (due to time slots unavailability), a customer receives a suggestion to book in a different date/time and same grocery shop

1.C Definitions, Acronyms, Abbreviations

1.C.1 Definitions

- **Customer:** a person who does/is going to do the grocery shopping
- **Ticket machine:** a machine equipped with a touchscreen display, a printer system, a QR code reader and an *ad-hoc* version of *Customers Line-up* application
- **Guest:** a person who has downloaded *Customers Line-up* mobile application on his smartphone/tablet, but has not registered or logged in yet; for this reason, he is not allowed to use the full set of functionalities offered by the app in the new class diagram there is no guest: fix
- **User:** a person who has downloaded *Customers Line-up* mobile application on his smartphone/tablet and has successfully logged in **OR** a person who uses *Customers Line-up* services through a ticket machine **OR** a person who uses *Customers Line-up* services by calling the call center

1.C.2 Acronyms

- **QR:** *Quick Response*
- **GPS:** *Global Positioning System*
- **RASD:** *Requirements Analysis and Specification Document*
- **CLup:** *Customers Line-up*
- **IVR:** *Interactive Voice Response*
- **SMS:** *Short Message Service*
- **DB:** *Database*
- **SIM:** *Subscriber Identity Module*
- **UML:** *Unified Modeling Language*

1.C.3 Abbreviations

Gn	Goal number n	*Defined in section 1.A*
WPn	World phenomena number n	*Defined in section 1.B*
SPWn	Shared phenomena (World controlled) number n	*Defined in section 1.B*
SPMn	Shared phenomena (Machine controlled) number n	*Defined in section 1.B*

1.D Revision history

Version	Date	Authors	Summary
1.0		Cosimo Sguanci, Roberto Spatafora, Andrea Mario Vergani	First release

1.E Reference Documents

- Software Engineering 2 slides (available on the Beep page of the course)
- Project assignment document (“R&DD Assignment A.Y. 2020-2021.pdf” available on the Beep page of the course)
- RASDs developed by colleagues of past years (available on the Beep page of the course or on GitHub)

1.F Document structure

- ➢ **Section 1** provides an overview of *Customers Line-up*'s goals and the context in which it is thought to work. In addition, all released versions of this document are summarized in an appropriate paragraph.
- ➢ **Section 2** …
- ➢ **Section 3** …
- ➢ **Section 4** …
- ➢ **Section 5** summarizes the total effort spent for realizing the *Requirements Analysis and Specification Document* by each group member.
- ➢ **Section 6** lists all references that helped the team during analysis and document writing.

2 Overall description

2.A Product perspective

2.A.1 Further details on the Shared Phenomena

Shared phenomena controlled by the World and observed by the Machine

- **SPW1:** A customer gets a ticket
  A customer can acquire a ticket reservation by using one of *CLup*'s application interfaces; a ticket corresponds to virtual lining up and is associated with a code for entering the selected grocery shop. After getting a ticket, the user waits until his turn comes.
- **SPW2:** A customer deletes his booked ticket
  A customer can delete a ticket reservation by using one of *CLup*'s application interfaces. When a ticket is deleted, the user implicitly leaves the waiting "queue" which regulates entrances in the grocery shop.
- **SPW3:** A customer books a visit
  A customer can book a visit reservation by using one of *CLup*'s application interfaces; a visit is associated with a grocery shop, date, hour and a code for entrance. A visit can be reserved either for the current day or in advance.
- **SPW4:** A customer deletes his booked visit
  A customer can delete a visit reservation by using one of *CLup*'s application interfaces. When a visit is deleted, the user frees the time slot associated with it.
- **SPW5:** A customer exits from the grocery shop
  When a customer exits from a grocery shop, he has to show the code associated with his reservation to an appropriate system: in this way, *Customer Line-up* can know the actual number of people inside the supermarket (and other information) and has the possibility to manage the influx of new people.
- **SPW6:** A time slot is available for a reservation
  When a time slot is available, every customer using *CLup* services can book it for having access to the corresponding grocery shop. Of course, time slots availability is associated with already registered reservations.
- **SPW7:** A customer gets a ticket/books a visit, but does not go to the grocery shop
  A customer might, for many reasons, not respect a reservation: this is the case of a person who completely forgets about his booked visit, or does not delete it (after deciding not to go to do the shopping). *Customers Line-up* in a sense tries to prevent these situations, and on the other hand reacts in an appropriate way when it faces them.

- **SPW8:** A customer gets a ticket/books a visit, but arrives at the grocery shop too late (after his turn and the associated time limit to enter)
  A customer might be late for many reasons: wrong time estimation to get to the grocery shop, other commitments, ...
  Customers Line-up in a sense tries to prevent these situations (making it easy to arrive on time), and on the other hand reacts in an appropriate way when it faces them.

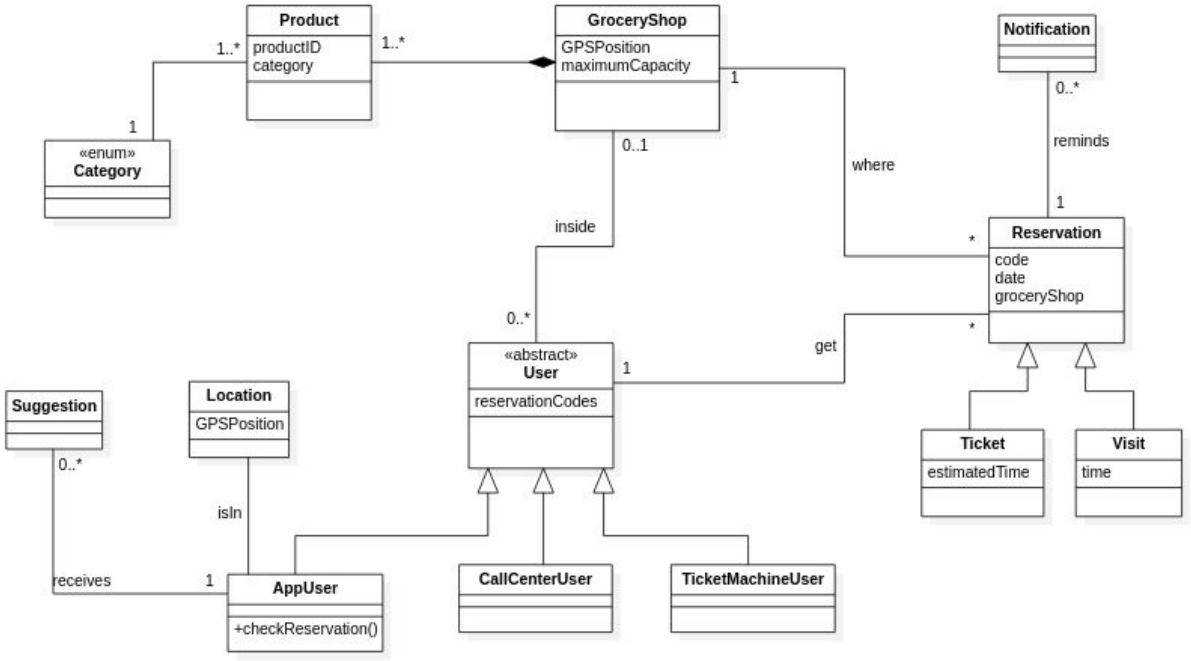
Shared phenomena controlled by the Machine and observed by the World

- **SPM1:** A customer enters in the grocery shop
  A customer can access the grocery shop only if he has a reservation. In practice, the user waits in the supermarket's proximity until his turn comes; then, he can enter only by showing (or typing) the code associated with his visit/ticket at the shop's entrance. Once in, the person can do the shopping.
- **SPM2:** A customer is notified for entrance
  CLup mobile application users, waiting for their turn outside the supermarket, receive a notification (on the app and via SMS) when they are allowed to enter. This system is very useful in order to guarantee social distance, permitting people to wait where they prefer: in fact, every communication message can arrive through *Customers Line-up* mobile application.
- **SPM3:** A customer is notified to leave from home
  CLup mobile application users, who have already booked a reservation for the current day, receive a notification (on the app) when it is time to leave from the place they are in order to reach the supermarket (on time). In this case, information about the customer's position is known thanks to GPS.
- **SPM4:** A customer receives a notification suggesting to book a visit in his habitual grocery shop, day of the week and hour
  CLup mobile application users might receive notifications (on the app) when an appealing time slot is available. In practice, the system tries to infer customer's habits and proposes ideal options to do the grocery shopping; most likely days, hours and supermarkets for every user are derived from customized statistics.
- **SPM5:** After a failure in the attempt to reserve a visit (due to time slots unavailability), a customer receives a suggestion to book in a different grocery shop
  Due to general restrictions and imposed maximum number of people inside every grocery shop, it might be the case that many time slots for reservation are unavailable (already booked). Of course, this might be stressing for a customer, because finding an option for grocery shopping can be harder than expected. *Customers Line-up* tries to help mobile app users, by proposing alternatives when their first choice for a visit is not available: a

proposal consists in a different shop (close to the selected one), in the same day and (approximately) hour chosen by the customer.

- **SPM6:** After a failure in the attempt to reserve a visit (due to time slots unavailability), a customer receives a suggestion to book in a different date/time and same grocery shop
  As described before, *Customers Line-up* helps mobile app users in finding the perfect visit for them, in case their first choice is not available. A proposal can be a different date/hour (with similarities to the selected ones) and same shop. The customer can accept the suggestion or decide to manually look for other options.

2.A.2 UML Class Diagram



2.B Product functions

Customers Line-up is an application born with the intention of avoiding (physical) crowds outside grocery stores, during a critical epidemic situation. Of course, together with basic functions associated with the need of respecting social

distance, the software provides a series of additional features, further detailed in this section.
A list of *CLup* main functionalities follows.

- **Get a ticket**
  Customers who would like to reserve a ticket for accessing the supermarket, without physically lining up, can get one using *Customers Line-up* service. The feature of getting a ticket can be achieved in three ways: the first one is using a smartphone/tablet, the second one calling *CLup*'s call center, the last one with a ticket machine (outside the grocery shop).
  Tickets correspond to "virtual" lining up: when someone gets a ticket, he becomes the last one to wait in the "queue"; if current day's time slots are all reserved (according to the supermarket's opening hours), no more tickets are assigned. A relevant aspect is that visits fill the same "queue" as tickets, but they can be reserved in advance (so, also some days/weeks before the date of the visit itself); in addition, in case of delay or incorrect waiting time estimation because of external factors, visits have priority in being called: visit time is more likely to be respected rather than ticket expected time (a person with the ticket can wait more because entrance hour is not guaranteed, while visit one tends to be, according to real world situations).
  Every customer can download *CLup* application on a mobile device; in order to get a ticket with the app, the guest needs to be registered and specify which grocery shop he wants to visit.
  People not owning a smartphone/tablet can get a ticket reservation by making a phone call to *Customers Line-up* freephone number: in this case, the user can complete the procedure interacting with an IVR system featured with voice recognition, or talking to a human operator; the selected grocery shop and a mobile phone number for notifications must be specified.
  In alternative, a person can go directly to the supermarket and get his ticket (if available for that day) using a ticket machine: in this case, there is no need to specify the grocery shop (implicit: it is the closest one), nor to be registered; tickets are printed on paper in the form of QR code, with the addition of a 6-digits number identifying the turn in the waiting "queue".

- **Book a visit**
  People, through *CLup* service, can book a visit for accessing the supermarket, avoiding physical lining up. The functionality of booking a visit, with strong analogy to a ticket reservation, can be achieved in three ways: using a mobile device, calling the call center or with a ticket machine (outside the grocery shop).
  Every customer can download *CLup* mobile application; in order to book a visit with the app, he needs to be registered and specify which grocery shop he wants to visit, in which day and time. A user might also specify the approximate duration of his visit and the categories of items (if not exact items) he is going to buy, in order to help the system to coordinate other customers' visits/entrances with tickets.
  The second option to book a visit is through *Customers Line-up* call center:

the procedure is very similar to the one of getting a ticket; the only difference consists in specifying, in addition to the selected grocery shop and a mobile phone number, the day and time for the reservation.
Alternatively, if there aren't available tickets for the rest of the day, a visit for the first available slot can be booked directly from outside the supermarket, using a ticket machine. [TO BE REVIEWED] (again, no registration and no specification of the grocery shop): visit reservations are printed on paper in the form of QR code (with the addition of a reservation receipt containing all relevant information: supermarket, date, time, 6-digits number for turn identification in the "queue").

- **Delete a reservation**
  Users can delete reservations connected to a ticket or to a booked visit. In order to do so with the mobile application, the user should open the page regarding information about his tickets/visits and select the one he wants to delete.
  The equivalent operation can be performed for tickets or visits connected to a call center reservation: the user should call *Customers Line-up* freephone number and follow the steps until deletion has been confirmed.
  Finally, for deleting reservations booked using a ticket machine, the customer should simply scan the printed QR code with the machine's scanner.

- ***CLup* suggestion mechanism**
  The system, for registered customers using the mobile application, is able to suggest time slots (for visits) based on specific users' habits. In particular, *CLup* stores all data about customers, days and time for visits, as well as most visited supermarkets; analyzing this data, the application can send customized notifications when an attractive visit can be booked.
  Other features for suggestions include giving alternatives after failures in getting a ticket or booking a visit (because no slots are available): for tickets, the system proposes to get one in the closest supermarket (with respect to the selected one) still available for current day; for visits, suggestion coincides with the proposal of a slot for a different hour/a different day/a close supermarket.
  An important remark consists in saying that these features are available only for customers using the mobile application.

- ***CLup* avoids people crowding inside the supermarket**
  The system can manage slots according to known (or inferred) duration of customers' visits and categories of items to buy. The general idea is that, knowing more information, *CLup* can more precisely stagger reservations in order to avoid crowds inside the supermarket. Data is collected by the system; the user can specify it (approximate visit duration and categories/list of items) when booking a visit. In any case, additional relevant information is also retrieved on the spot: time duration spent inside the supermarket and bought items. The information about the average time spent inside the shop by a single user is used to adjust the timetable for other users that may want to book an entrance for the same day: if a user with an average time of visit of one hour and a half booked a

place for 6 pm, other users will see an available place starting from 7:30 pm. At the same time, data about which items are usually bought by a single customer is used to show different available slots to different users: there is a risk of crowding inside the shop if too many customers that buy similar or near products book a slot for the same date and time. [TO BE REVIEWED]
The described feature is customized for mobile application users; for customers without the app, estimations are performed (according to average data).

- ***CLup* sends notifications based on GPS position**
  The system, for registered customers using the mobile application and having an active GPS connection on their smartphones, is able to notify them when their reservation (ticket or visit) is approaching. In particular, every time a visit is being booked, the user is asked which kind of means of transport he/she is going to use. This information, combined with the real-time GPS position, allows *CLup* to compute the time needed to get to the supermarket and send the customer a notification so that he can get on time to the grocery shop, without forming unnecessary crowds outside the shop. [TO BE REVIEWED]
  If GPS connection is not active, the user still receives notifications about an approaching reservation, but only in predefined times.