

# 1. INTRODUCTION

## 1.1. Purpose

CLup aims to provide chains of stores with a reliable solution to the problem of people gathering inside and outside the shops.

To face the problem, the application focuses on its principal causes, which are the management of people inside the store, that often leads to overcrowding, the effectiveness of standard queuing systems and the way people are allowed to visit the stores. Moreover, the system aims to provide a useful tool for store managers in order to help them in administering stores and monitoring their status.

In particular, the main goals that CLup aims to achieve, summarized in the table below, are the following:

- Prevent the store from being overcrowded, in order to avoid indoor gatherings while maximizing its occupancy, by means of an access management system
- Reduce gatherings of people waiting to enter outside the store, providing a way to virtualize queues
- Provide a more efficient way to access stores, reducing the time customers waste while waiting to do it
- Help store managers in monitoring the status of the store and regulating the influx of people

More details on how CLup is supposed to fulfill these goals are in the Requirement Document.

## 1.2. Scope

During the current situation of emergency, it is fundamental to prevent contacts among people. For this reason, governments impose strict rules concerning social distancing, both for indoor and outdoor contexts.

However, crowding management inside stores like supermarkets and grocery shops could be challenging. Currently, stores limit the maximum number of people allowed, and therefore long queues arise: entering a store for a few minutes might even require hours. Moreover, customers who see a crowded store might avoid lining up to save time and prevent contact with others.

CLup fits into this context allowing customers to remotely line up in a queue of a given store and to be notified when they should head toward it. Furthermore, it allows the customer to

book a visit for a store on a specific day and time, which grants him priority over the queued customers.

Users can interact with CLup thanks to two distinct interfaces: one is an easy-to-use application designed for the customers, while the other one is an administrative tool that allows store managers to monitor their stores and modify their parameters.

Moreover, CLup also provides physical proxies outside the stores as a fallback option for users who want to line up but do not have access to the application.

### 1.3. Definitions, Acronyms, Abbreviations

<b>AMS</b>	Access Management System
<b>TAS</b>	Turn Announcement System
<b>CLup</b>	Also known as the system. It is the software to be developed. From a design-oriented point-of-view, the term is also used to refer to the mobile application, the administrative tool and the server all together
<b>Customer application</b>	Also known as application. It is used to access the functions provided by CLup
<b>Administrative tool</b>	The tool provided to store managers in order to administer stores
<b>Proxy</b>	The physical fallback option for customers that want to use CLup but cannot use the application. It is placed outside the store it belongs to
<b>Turn Announcement System</b>	An external system which informs customers about who has been allowed by CLup to enter the store it belongs to
<b>Access Management System</b>	An external system which regulates physical entrances and exits to the store it belongs to by interacting with CLup
<b>App-customer</b>	A customer who uses CLup functions through the application
<b>Proxy-customer</b>	A customer who uses CLup functions through the proxy
<b>User</b>	Either a customer or a store manager
<b>Long-term customer</b>	With respect to a certain store, a customer who already used CLup to visit it
<b>Current occupancy</b>	Also known as occupancy. It can be referred to the store or one of its sections. It is the number of people inside it
<b>Maximum occupancy</b>	Refers to the store or one of its sections. It is the maximum number of people allowed to be in that area

<b>Virtual queue</b>	Also known as access queue or simply queue. It represents the set of customers who lined up through the app or the proxy
<b>Line up</b>	With respect to a customer and a store, it is the event of joining the queue
<b>Visit request</b>	A customer's request to visit a store. It can be either a line-up request or a booking request
<b>Line-up request</b>	A request made by the customer to line up for a store
<b>Booking request</b>	A request made by the customer to book a visit to a store
<b>Visit</b>	The realization of a visit request which takes place when a customer enters the store. After the customer exits the store, we talk about <i>completed visit</i> , otherwise it is a <i>visit in progress</i> .
<b>Visit token</b>	A unique token bound to a visit request. It allows the Customer to enter and exit the store
<b>Pending request</b>	A customer's visit request that does not have a completed visit associated with and is not allowed to enter the store it is associated with
<b>Ready request</b>	A customer's visit request that does not have a completed visit associated with and is allowed to enter the store it is associated with
<b>Fulfilled request</b>	A customer's visit request that has an associated <i>visit in progress</i>
<b>Completed request</b>	A customer's visit request that has an associated <i>completed visit</i>
<b>Active request</b>	A customer's visit request that is not a completed request (thus it is either a pending, a ready or a fulfilled request)

## 1.4. Revision history

1.0 - First version of the document (DATA FINALE)

## 1.5. Reference Documents

IEEE standard for Software Design Descriptions, IEEE 1016-2009

R&DD Assignment AY 2020-2021

CLup Requirements Analysis and Specification Document (RASD)

Teaching material provided by professors Matteo Rossi and Elisabetta di Nitto

## 1.6. Document Structure

The reference structure used for the document is an adapted version of the one suggested by professor Matteo Rossi of Politecnico of Milan. It is derived from the IEEE standard, which is used as a reference document (IEEE standard for Software Design Descriptions, IEEE 1016-2009).

Chapter 1 is an introduction to the software to be designed and developed and to the problem that it addresses. It presents the goals that should be achieved and an analysis of the context in which the system will be placed.

Chapter 2 defines the system architecture. It includes a view of the system components and of their interfaces, a view about the deployment choices and some views about the runtime behaviour of the system. It also explains all the other design decisions.

Chapter 3 focuses on the design of the user interfaces. It also illustrates the users interactions with the system through mockups.

Chapter 4 better details the connections between goals and requirements already mapped in the RASD, taking into account the system components identified in Chapter 2

Chapter 5 focuses on future plans about the implementation, the integration and the testing of the system components.

Chapter 6 contains a report on the effort spent by all the members of the group while writing the current document.

## 2. ARCHITECTURAL DESIGN

### 2.1. Overview

The following sections are about the architecture of CLup. In order to better understand the whole document and to make it more self-explanatory, some recalls from the CLup Requirements Analysis and Specification Document follow, including an updated class diagram that considers a more design-oriented point-of-view.

**Table of functional requirements**

<b>R1</b>	The system shall allow managers to specify the store parameters
<b>R2</b>	The system shall allow managers to monitor entrances
<b>R3</b>	The system shall allow managers to monitor exits
<b>R4</b>	The system shall authorize accesses to the store
<b>R4.1</b>	The system shall authorize customers to enter if and only if the store would not exceed the maximum number of people allowed inside it
<b>R5</b>	The system shall provide a way to line up in the virtual queue of the store
<b>R6</b>	The system shall provide a way to exit the queue before entering the store
<b>R7</b>	The system shall alert the app-customer when it is time to reach the store
<b>R8</b>	The system shall provide the possibility to book a time interval for visiting the store
<b>R9</b>	The system must not allow customers to book a visit in a time interval if, over its duration, bookings by other users already maximize store occupancy
<b>R9.1</b>	The system must not allow customers to book a visit in a time interval if, over its duration, bookings by other users already maximize at least one of the product sections specified in the booking request
<b>R10</b>	When booking a visit, the system shall allow customers to specify what kind of products they intend to buy
<b>R11</b>	The system shall provide the possibility to cancel a booked visit before entering the store
<b>R12</b>	While making a booking request, the system shall suggest alternative time intervals if the demand of the chosen one is too high
<b>R13</b>	While making a booking request, the system shall suggest alternative stores of the same chain if the demand for the chosen time interval in the selected store is too high
<b>R14</b>	The system shall allow managers to regulate entrances
<b>R15</b>	The system shall allow managers to regulate exits

<b>R16</b>	The system shall notify a customer when, during a specific time interval, a specified store is reaching its maximum occupancy
<b>R17</b>	The system shall keep track of the average duration of a generic visit to the store
<b>R18</b>	The system shall manage the case in which customers do not show up when it is their turn to enter the store
<b>R19</b>	The system shall inform customers when they are allowed to enter the store

**Table of nonfunctional requirements**

<b>NF1</b>	The system, in normal operating conditions, should be able to handle all line-up and booking requests of each customer.
<b>NF2</b>	The system responses and notifications must be sent within 3 seconds from the triggering event.
<b>NF3</b>	The software should be GDPR compliant
<b>NF4</b>	CLup should provide a high degree of reliability
<b>NF5</b>	CLup should be available the 99% of the time
<b>NF6</b>	The system should be protected against malicious attacks
<b>NF7</b>	The system must be well-documented and adaptable to changes
<b>NF8</b>	The CLup customer application should be compatible with most of the smartphones currently on the market
<b>NF9</b>	CLup should be platform independent
<b>NF10</b>	The application should be easy to use
<b>NF11</b>	CLup shall give priority to booking requests over line-up requests
<b>NF12</b>	Customers can remotely line up in a store's queue only if they are not in the queue of any store at that moment
<b>NF13</b>	Customers can book a visit to a store for a specific time interval only if they have not booked any other visit which overlaps with that time interval
<b>NF14</b>	Customers can book a visit to a store for a specific time interval only if it starts after the current queue disposal time of that store.