Requirement Analysis and Specification Document RASD

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Contents

Chapter 1

Introduction

1.1 Purpose

This document is Requirement Analysis and Specification Document(RASD). The main purpose of this document is the following points

- Communicates an understanding of the requirements to the audience and explains both the application domain and the system to be developed.
- Contractual: Make this project formal and written so that it has legal effect.
- As the baseline for project planning and estimation. i.e. size, cost, schedule.
- As the baseline for software evaluation

  It can support system testing, verification and validation activities

  It should contain enough information to verify whether the delivered system meets requirements
- As the baseline for change control, such as requirements change, software evolves.

And this RASD has the following intended audiences

- Costumers & Users : Some user may interest in validating system goals and high-level description of functionalities.
- Systems and Requirements Analysts: The RASD may help them to write various specifications of other systems that inter-relate.

- Developers, Programmers: The RASD may help the to implement the requirements
- Testers: The RASD may help the to determine that the requirements have been met
- Project Managers: The RASD may help them to measure and control the analysis and development processes

1.2 Scope

1.2.1 Description of the given problem

At the end of 2019, a global epidemic broke out and swept almost all countries in the world in just a few months. Starting in 2020, people's life rhythm has been completely disrupted by this epidemic, a lot of cities are blocked, people are allowed to exit their homes only for essential needs, everyone had to wear masks and respect the social-distancing at least 1.5 m. In the public area, the human community has to take measures to avoid the crazy spread of the virus. Restaurants began to use dividers to separate the table, supermarkets and museums began to restrict flow of people, the school also adopted into two classes mode: online and onsite.

In this situation, a new problem arises, how to delay the spread of the virus through technical means?

Since grocery shopping is the most needed activity under the lock-down, so let's narrow the problem to grocery shopping.

In the supermarket, In order to meet these strict rules, many challenges have arisen, so, we can turn to technology, in particular to software applications, to help navigate the challenges created by the imposed restrictions.

So, this project appeared - Customers Line-up(CLup).

1.2.2 World Phenomena

WP_1	cell
WP_2	cell
WP_3	cell

1.2.3 Shared Phenomena

SP_1	cell
SP_2	cell
SP_3	cell

1.3 Definitions, acronyms, abbreviations

1.3.1 Definitions

- Click Customer : The customer has the required technology to access the store. I.e a smartphone. They can use the customer terminal software.
- Brick Customer : The customer doesn't have the required technology to access the store, they have to hand out "tickets" on the spot.
- Store Manager : They have to manage the Store System, include the software and hardware.
- Ticket: The ticket is a document which contains three key information: QR Code, the estimated departure time, the queue number, and the Store Planned Roadmap. To the click customer, it's **E-ticket** but to the brick customer,it's **Paper Ticket**,and doesn't contain the estimated departure time, and just a General Store Map without the Planned Road.
- QR Code : When customer booked a visit, they will received a QR Code.
- QR Code Scanned Machine : A hardware, the Click Customer can use this machine scan their QR code.
- Tickets Hand-Out Machine : A hardware, the Brick Customer can use it retrieve their Ticket.
- Store Planned Roadmap: A store map that includes a finer way which is recommended form Store System.
- Digital Counterpart : A hardware, it with show the queue number.
- Store Back-End System : A software, as the back-end manages all stuffs.
- On-Time Store Data : A dataset that includes the store's on-time date.
  - The current Query
  - The customers in the store
  - The maximum number of people in the store.
- Long-Term Customers : The customers with the high average duration of the visit, we set the threshold value to 1 hour.

1.3.2 Acronyms

- RASD – Requirement Analysis and Specification Document
- CLup - Customers Line-up
- UI - User Interface
- IOS - iPhone OS
- PC - Personal Computer
- IaaS - Infrastructure as a Service
- CRM - Customer Relationship Management

1.3.3 Abbreviations

- WP_n : n-th world phenomena
- SP_n : n-th shared phenomena
- G_n : n-th goal
- D_n : n-th domain assumption

1.4 Reference documents

- Specification Document: "R&DD Assignment A.Y. 2020-2021"
- Slides of the "Software Engineering 2" course A.Y. 2020-2021
- IEEE Recommended Practice for Software Requirements Specifications - IEEE Std 830-1998
- Fondamenti di Sistemi informativi per il Settore dell'Informazione - 7 settembre 2018
- Poste Italiane - www.poste.it

1.5 Overview

The RASD document consists of five chapters.

Chapter 1 is the introduction chapter, it's an overview of the RASD and project, it describes the purpose of the CLup.

Chapter 2

Chapter 3

Chapter 2

Overall Description

2.1 Product perspective

The CLup – Customers Line-up system can be divided into three parts. Three client ends and a server end, The client ends are divided into consumer end and store manager end according to the object-oriented. And we have divided consumers into two groups according to their characteristics, we referred to the the Business direction's click and brick concept of information system, and decided to name it "click and brick customer", the click customer will use the mobile application, and the brick customer will use the Tickets Hand-Out Machine in the store.

The mobile application for the click customer can install in the Android and IOS operation system, to make this app simple enough for everyone, we just design two main functions : Sign-up/in and Booking Function. when they book a visit, they have to input four information, that are visit date/time, the approximate expected duration of the visit, the categories of items that they intend to buy, and the place they depart from, for the depart place, if the depart place is the same as the current place and the GPS is available, the place information will input automatically by the application, by the way, if the customer does not want the application to get the GPS authority, he can also input manually, It can even be a fuzzy address, as long as it does not affect the calculation of the time to arrive the store. After they have booked a visit and the back-end system confirmed it, they will receive the E-Ticket with four data, QR Code, Query Number, the estimated departure time and the Store Planned Roadmap. The recommended route on the map may only be displayed when they depart.

The Tickets Hand-Out Machine is usually placed at the entrance of the store,we just design only one button, that is retrieve a Ticket,no book a visit

function, because we consider that the customer going out to pick up the number and wait until the book time to re-come to the store will significantly increase the number of outings,so we did not set up a booking process on the machine, otherwise, we mix the query of two kind of customer through the Store Back-End System's query schedule function to try to best to reduce the wait time.

The manager end is a software can install in a simple PC, the manager can use it to monitor the number of people in the store in real-time, if something unexpected happens,for example, there are too many people in the store or too many people in one area, The store manager can solve this problem in two ways, first of all, he can lower the maximum people value in the store, so that the customer in the query will enter more slow, on the other hand, for an overcrowded area, he can adjust the customers who need to enter this area in the queue and let them enter the store later. After all,if the queue is too long due to these problem, he also can reschedule customers' book, but **only the book of customers before the departure time can be rescheduled**.

The most important part of this system is the server end, the server end is implemented the Store Back-End System, this system have to communicate with all other ends and control the Digital Counterpart. It contains three function, Booking Schedule Function, Query Schedule Function, Customer Relationship Management System. The Booking Schedule Function have to communicate with CRM, take the booking data, schedule the booking and put the enter time for each book to CRM system. For the Query Schedule, We refer to the queuing mode of the Poste Italiane that has been practiced very maturely. To the Poste Italiane, you can book your visit on the Ufficio Postale App, or just retrieve the ticket on the Machine, the back-end system will mix two query reasonable. For our Query Schedule Function, In order to achieve the goal G_2 we have higher requirements, that is we must have a better mechanism so that both types of customers do not need to queue for too long, thereby reducing risk. Finally the CRM System, this sub-system have to store customer's information, analysis the customer's history duration to make if this customer is a Long-Term Customers, received the booking, communicate with Booking/Query Schedule function, calculate the estimated departure time, plan the Store Planned Roadmap, generation query number/QR code and put those all in the E-Ticket, by the way, when the Store Manager reschedule the booking,send notification and update the E-Ticket for the Customer.

2.1.1 Class Diagram and State Diagram

Class Diagram

The Class Diagram model as shown in Fig.2.1, These classes implement the three functions of the Store Back-End System,the Customer Relationship Management sub-System composed by the Customer class, Booking, Ticket, and CRM class, Among them, the CRM class is responsible for communicating with other ends,and it can control customer class's status,the Customer data will store in Database. The BookSchedule class implement the Booking Schedule Function, all booking data will store in database, and this class can control them. The last class is the QuerySchedule class, it will implement the Query Schedule Function, it will take booking information and get Brick Customer's ticket information to schedule the query, the store manager can check the length of the query and the maximum number of customer in-store, when he found that somewhere in the store was too crowded, he can lower the maximum value. The CallNextCustomer method will control the Digital Counterpart to make it display the next customer's query number according to the maximum number allowed in the store. In summary, these functions form a set of effective mechanisms to achieve the goals.

State Diagram

The State diagram Fig.2.2 illustrated the processing of a customer to require the E-ticket. Customers first state their requirements (time, goods, etc.), and then go to the store according to the expected departure time given by the application, after enter the store with E-ticket.

The State diagram Fig.2.3 showed us how the manager monitors the entry and exit of the store and helps some customers who do not have access to the required technology.

The State diagram Fig.2.4 represented the serve end proceed various requirements. It receive the data from customers and store manager, analyzed customer data and make the best solution. For longterm customers, system will according to previous visits to estimate the shopping time. Meanwhile, system will based on the categories of items that customer desired to buy, to allow more people to enter the store, due to they will occupy different spaces in the store when they shopping and also satisfy the enough distance between each customer.

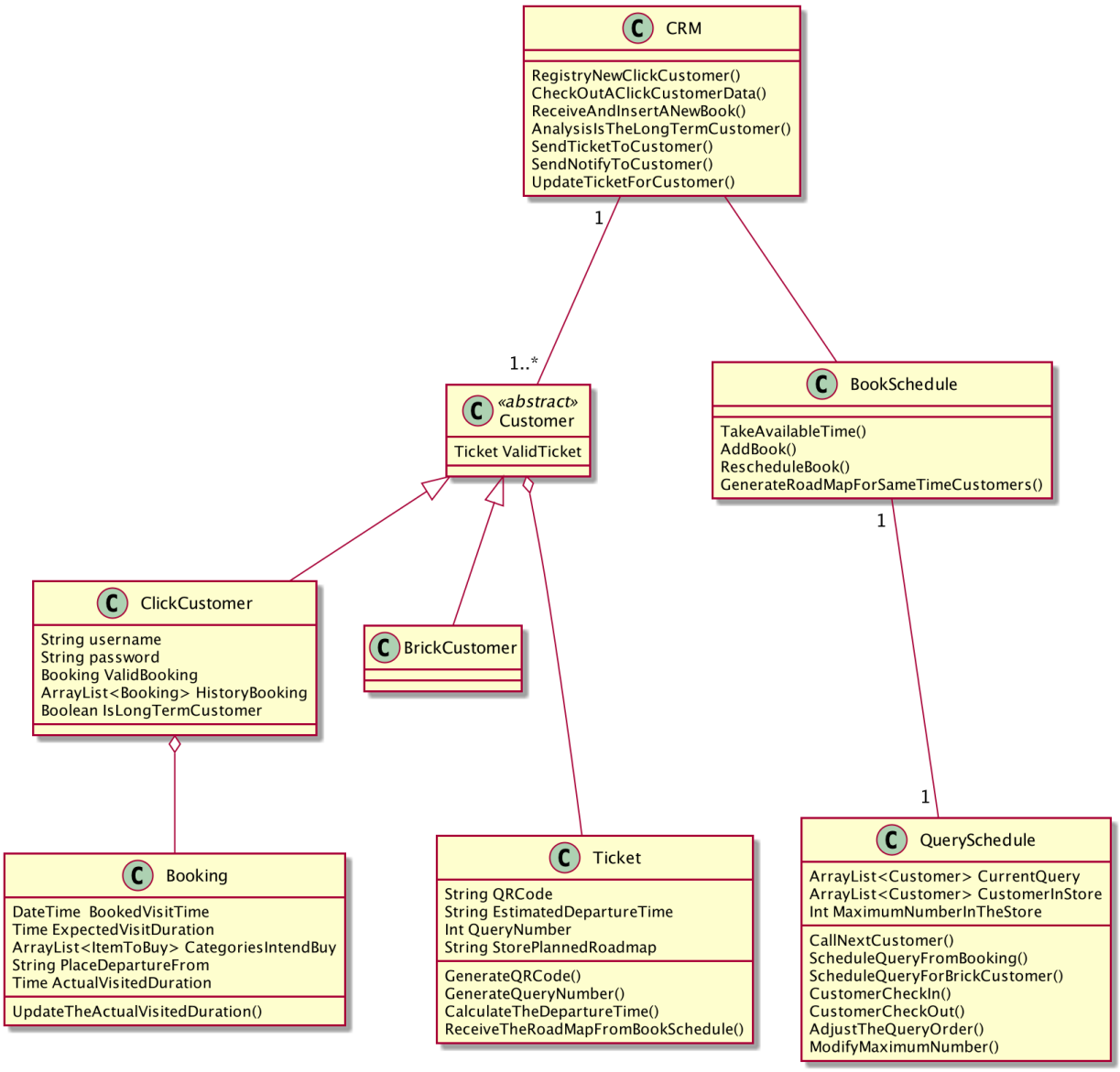

Figure 2.1: CLup Class Diagram

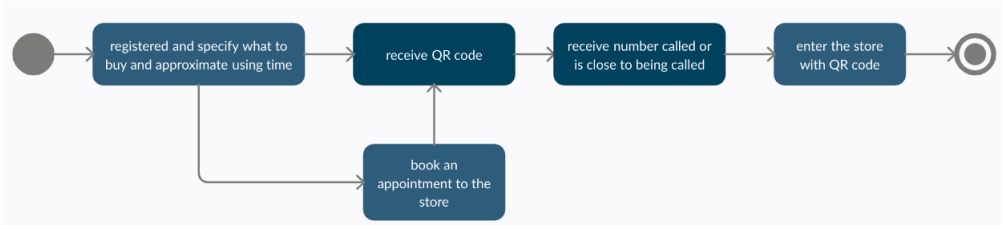

Figure 2.2: Customer State Diagram

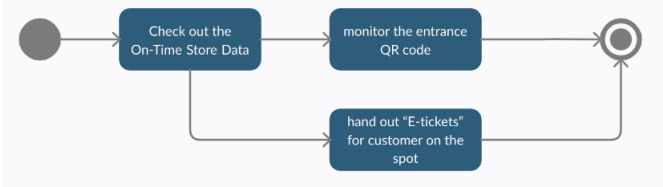

Figure 2.3: Store Manager State Diagram

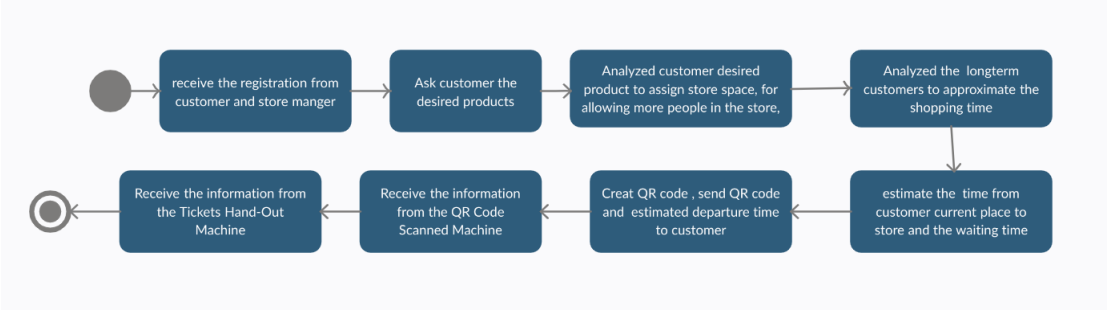

Figure 2.4: Server End State Diagram

2.2 Product functions

2.2.1 Functional Requirements

- Each Click Customer shall be able to:
  - Sign-up
  - Login
  - Book a visit,to complete it, they have to indicate the following data
    - Indicate the desired date and time
    - Indicate the approximate expected duration of the visit
    - Indicate the categories of items that they intend to buy
    - Indicate or given by GPS the current place they want to depart to the shop
  - Receive the E-Ticket
  - Received the notification and update the E-ticket from store manager when their book is rescheduled.
  - The customer can scan the QR Code at QR Code scanned machine when they enter **and** leave the store.
- Each Brick Customer shall be able to
  - Retrieve the Ticket from Tickets Hand-Out Machine and wait the Digital Counterpart call them.
  - Scan the QR Code at QR Code Scanned Machine when they enter **and** leave the store.
- Store Manager shall be able to:
  - Check out the On-Time Store Data.
  - Adjust the maximum number of people in the store.
  - Adjust the order of the query.
  - Check and reschedule the booking.
- The Store Back-End System shall be able to:
  - Send the available time/date to the the click customers.

- Received and schedule the click customers' book, the scheduling have to refer the duration time of each customer and the categories of items that the customer intend to buy
- Calculate the time from the click customer's departure place to the store,and put the estimated departure time on the E-Ticket.
- Plan and put the Store Planned Roadmap on the E-Ticket
- Send the E-Ticket to the click customers.
- Send a notification and update the E-Ticket to the customer when their book is rescheduled.
- Store the customer's data,include:
  - Username
  - Password
  - Valid Booking data
  - History visit data.
  - Is long-term customers
- Analysis the history visit data and mark the Long-Term Customers.
- Calculate and store the On-Time Store Data.
- Schedule or reschedule the order of query from click customer's book and brick customer's retrieved ticket.
- Control the Digital Counterpart and display the query number.
- Receive the information from the QR Code Scanned Machine.
- Receive the information from the Tickets Hand-Out Machine.

2.2.2 Non-Functional Requirements

- The time from the click customer's departure place to the store that calculate from the Store Back-End System must enough precise to avoid the customer arriving at the the store too early/late.
- The Store Back-End System must schedule the query reasonably to minimize the wait time.
- The Store Back-End System must mix the book and brick customer's retrieved ticket reasonably to allow the click customers enter the store near the book time, by the way avoid making the brick customers wait too long.

- Make sure that the supermarket is not overcrowded in each area, and the queue is not too long.
- Cause of everyone needs to do grocery shopping, the software for the click customer should be enough simple to use,.

2.3 User characteristics

The system will include three categories of user, each of them with different needs: The Click Customer : //TODO The Brick Customer The Store Manager

2.4 Constraints

There are not many constraints on customer's device, only need a smart phone with Android or IOS operation system, when they book a visit, the smartphone has to connect with internet, at other time, no need for a stable internet connection,only need to be able to connect to the Internet discontinuously to receive reminders that may appear. The manager needs a PC with stable network connection. For the Store Back-End System, we buy a Amazon EC2 IaaS to implement this system.

2.5 Assumptions, Dependencies

2.5.1 Domain Assumptions

- D_1 : Everyone will leave the departure place at the departure time indicated by the system.
- D_2 : Everyone who leaves on time can arrive at the store on time.
- D_3 : Everyone can leave the store in time according to their estimated time.
- D_4 : If something unexpected happens, the store manager can adjust the maximum number of people in the store or reschedule the query & customer's book reasonably.
- D_5 : If someone's book is rescheduled, he can find the notification in time and set off according to the updated E-Ticket.

- D_6 : Everyone can consciously scan the QR code at the entrance and exit.
- D_7 : Everyone can follow the Planned Roadmap in the store.
- D_8 : If is possible, everyone tries to best book the visit by the software(be a Click Customer) instead of picking up tickets on the spot(not be a Brick Customer).

2.5.2 Goals

There are only three main goals of this system.

- G_1 : Allows store managers to regulate the influx of people in the building.
- G_2 : Saves people from having to line up and stand outside of stores for hours on end.
- G_3 : The application plan visits in a finer way to allow more people in the store, at the same time, let the customer occupy different spaces in the store to keep enough distance between them.

Chapter 3

Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

3.1.2 Hardware Interfaces

3.1.3 Software Interfaces

3.1.4 Communication Interfaces

3.2 Functional Requirements

3.2.1 User Class 1

Functional Requirement 1.1

3.2.2 User Class 2

Functional Requirement 2.1

3.3 Performance Requirements

3.4 Design Constraints

3.4.1 Standards compliance

3.4.2 Hardware limitations

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

3.6 Other Requirements

Chapter 4

Formal Analysis Using Alloy

//TODO but **only the book of customers before the departure time can be rescheduled**. max number

Chapter 5

Effort Spent

- **Kong Xiangyi**

Date	Task	Hours
2020/10/10	Group discussion project plan	4h
2020/10/31	Modified the purpose and scope of the RASD	2h

- **Zhang Yuedong**

Date	Task	Hours
2020/10/10	Group discussion project plan	4h
2020/10/19	Added the project's architecture	1h
2020/10/30	Added the purpose and scope of the RASD	2h
2020/11/16	Wrote the product functions part	4h
2020/11/17	Drawn the class diagram in the Section 2.1.1	2h
2020/11/27	Fixed the problem of the second chapter	1h