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RASD - Requirements Analysis and Specifications Document

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1. Introduction

1.1 Purpose

1.1.1 General Purpose

SafeStreets is a crowd-sourced application that intends to provide multiple software-based services concerning road and traffic violations.
In detail, it allows:

1. users to have the possibility to notify the system when traffic violations occur, and in particular parking violations;
2. to cross system's data with those made available by the municipalities, like information of local accidents, to identify potentially unsafe areas, and let the system suggest possible interventions to the involved municipality;
3. local police of a municipality to generate traffic tickets based on violations reported by registered users.

SafeStreets stores the information provided by users, completing it with suitable metadata. In particular, when it receives a picture of a violation, it runs an algorithm to read the license plate. Each user's report includes the type of the violation and the name of the street where the violation occurred, retrieved from the geographical position of the infringement.

The main aim of SafeStreets is to collect this information so that both end users and authorities can identify areas where multiple violations occur and the vehicles that commit the most violations.

If a municipality offers a service that allows users to retrieve the information about the accidents that occur on its territory, SafeStreets can cross this information with its own data to identify potentially unsafe areas, and suggest possible interventions, like adding a barrier between the bike lane and the part of the road for motorized vehicles to prevent unsafe parking.

The municipality and the local police could offer a service that takes the information about the violations coming from SafeStreets, and generate traffic tickets from it. In this case, entering a violations ensures that the information coming from the users is never broken, and the information is never altered, because all the provided pictures come directly from the application. The information about issued tickets are used by SafeStreets to build statistics, for example about the most egregious offenders, or the effectiveness of the SafeStreets initiative.

1.1.2 Goals

SafeStreets service aims to achieve multiple goals:

- G1: Allow users to log in the system
- G2: Allow users to notify a traffic violation
- G3: Allow users to receive feedback on the notification made (it can be accepted or refused)
- G4: Allow users to see the history of their own notified violations
- G5: Allow the possibility for the municipality to generate traffic tickets from the identified violations
- G6: Build statistics starting from the information about issued tickets
- G7: Allow authorities to access to the stored information
- G8: Cross system's data with those made available by the municipalities
- G9: Allow the municipality to receive suggestions for possible interventions

1.2 Scope

The purpose of the SafeStreets initiative is to raise citizens' awareness about the violations that are committed every day, allowing them to make reports for a more civilized city. In addition, for a municipality, a service like SafeStreets can help to determine which areas are considered unsafe and those with high rate of violations, so authorities can act on more accurate data and help to make the municipality optimally controlled. Finally, for authorities, being able to leverage on the service provided by SafeStreets can help to reduce the time needed to emit traffic tickets and to invest it in more important, resource-intensive activities.

1.3 Definitions, Acronyms, Abbreviations

1.3.1 Definitions

- Customer: general SafeStreets customer, can be user or authority.
- User: a normal application customer who notifies the authorities of a traffic violation.
- Authority: customer of the application who intervenes as a result of a traffic violation. It can be distinguished into municipality or local police.
- Violation: a set of photo and metadata that describes an attitude that is not in accordance with the rules of the road.

1.3.2 Acronyms

- GPS: Global Positioning System
- RASD: Requirement Analysis and Specification Document

1.3.3 Abbreviations

- Gn: nth goal
- Dn: nth domain assumption
- Rn: nth requirement

1.4 Revision history

- Version 1.0: First release

1.5 References

- Specification document: “Safe streets Mandatory Project Assignment”
- Slides RASD

1.6 Document Structure

The RASD document consists of 6 chapters described below:

1. The first chapter is an introduction. It defines the purpose of the system, underlining the goals that the application has to reach and it describes the scope of the project. It also contains some basic information to better understand the other chapters of the document.
2. The second chapter is made up of a description of the project. Here are identified and described the actors, the limits of the system and the necessary assumptions. This section includes details on the shared phenomena and a domain model, with class diagrams and state diagrams.
3. The third chapter is the most important of the document and it provides a more detailed description of the aspects presented in the previous chapter. It contains all the identified requirements necessary to achieve the goals defined in the first chapter. Here interface, functional e non functional requirements are defined. This chapter additionally contains a description of some of the scenarios identified, each of them describes a particular situation where the system has to deal with. Here are also defined the use case diagrams, use cases and associated sequence diagrams, that model the system in details.

4. The fourth chapter contains the Alloy model of some critical aspects of the system. Everything is explained in detail; in addition, to show the soundness and correctness of the model, a proof of consistency and an example of the generated world are provided.
5. The fifth chapter contains a detailed report of all the hours spent by each member of the group working on the project.
6. The last chapter includes references to the documents, texts and resources used to write this document.

2. Overall Description

2.1 Product Perspective

2.2 Product Functions

2.3 User Characteristics

2.4 Assumptions, Dependencies and Constraints

2.4.1 Domain Assumptions

- D1: The information coming from the users is never broken
- D2: Each email is unique
- D3: Each fiscal code is unique
- D4: The internet connection works properly without failure on user's device
- D5: GPS works correctly on the user's device when taking the photo
- D6: The date and time on the user's device are always updated and working properly
- D7: Each license plate is unique
- D8: Each vehicle has one owner
- D9: The traffic tickets are consistent with the violations committed
- D10: The data provided by the municipalities are always correct
- D11: Municipalities are willing to receive suggestions from the system

2.4.2 Text Assumptions

2.4.3 Constraints

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 Scenarios

Scenario 1

Maurizio sees a car parked in front of the driveway of his apartment building. Thanks to the registration made just the day before, he decides to take a picture in which the license plate of the car and the driveway are clearly visible and sends it to SafeStreets. Safe streets forwards the information to the local police who generates the traffic ticket and sends it to the owner of the car involved in the reported violation.

Scenario 2

SafeStreets after a year of activity decides to verify the effective working of the initiative and the interest shown by users in the service. The operator Stefano is then in charge of analyzing the stored data and generate statistics that will be studied by his bosses.

Scenario 3

Antonio to have fun with his friends sends reports where violations are non-existent. The game goes on but at the third wrong report, Antonio is blocked by the system and can no longer make reports.

Scenario 4

Anna, a SafeStreets operator, analyzing the data, realizes that in Milan in Viale Molise many machines end up off the road, causing a lot of damage and injury. Anna then suggests to the city of Milan to add a barrier to reduce the number of accidents. Fortunately, the municipality acts immediately, listening to the advice received.

Scenario 5

Alice notes that her neighbour, since he could not find a place to park, occupies the place reserved for the disabled. She then sends a picture to SafeStreets, which is analysed. However, the notification is refused because it is not possible to identify the plate, being partly hidden by a tree. Alice is then notified of the rejection of the violation and the reason for it. Fortunately, when Alice receives the feedback, her neighbor's car is in the same place. She then decides to send SafeStreets a new picture, being careful to get the license plate of the car right.

Scenario 6

Maria wants to help her son Giacomo get his license. Since her Giacomo is still inexperienced, she wants to take him to a safe area of the city to teach him the basics and to familiarize him with the car. For this reason, Maria opens the SafeStreets app and searches for the most dangerous areas of the city so as to avoid them and to have no problems.

3.2.2 Use Case Diagrams

3.2.3 Sequence Diagrams

3.2.4 Requirements

G1: Allow users to log in the system

- R1: The system should be available 24/7
- R2: the system offers the possibility to register, with the insertion of e-mail, password and fiscal code
- R3: The email used must be different for each account
- D2: Each email is unique
- D3: Each fiscal code is unique

G2: Allow users to notify a traffic violation

- R1: The system should be available 24/7
- R4: The system should allow registered users to exploit its features

- R5: The system should allow users to take a picture instantly and send it
- R6: The system offers a list of possible types of violations to report
- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- R9: An algorithm allows to recognize license plates involved in a notified violation
- D1: The information coming from the users is never broken
- D4: The internet connection works properly without failure on user's device
- D5: GPS works correctly on the user's device when taking the photo
- D6: The date and time on the user's device are always updated and working properly

G3: Allow users to receive feedback on the notification made (it can be accepted or refused)

- R8: The system must verify the correctness of the notification made
- R9: An algorithm allows to recognize license plates involved in a notified violation
- R10: A user is blocked if he makes more than 3 incorrect reports (there is no traffic violation in the report)
- D4: The internet connection works properly without failure on user's device

G4: Allow users to see the history of their own notified violations

- R1: The system should be available 24/7
- R4: The system should allow registered users to exploit its features
- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- D1: The information coming from the users is never broken
- D4: The internet connection works properly without failure on user's device
- D5: GPS works correctly on the user's device when taking the photo
- D6: The date and time on the user's device are always updated and working properly

G5: Allow the possibility for the municipality to generate traffic tickets from the identified violations

- R6: The system offers a list of possible types of violations to report
- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- R9: An algorithm allows to recognize license plates involved in a notified violation
- D1: The information coming from the users is never broken
- D3: Each fiscal code is unique
- D7: Each license plate is unique
- D8: Each vehicle has one owner
- D9: The traffic tickets are consistent with the violations committed

G6: Build statistics starting from the information about issued tickets

- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- R9: An algorithm allows to recognize license plates involved in a notified violation
- D1: The information coming from the users is never broken
- D7: Each license plate is unique
- D8: Each vehicle has one owner
- D9: The traffic tickets are consistent with the violations committed

G7: Allow authorities to access to the stored information

- R1: The system should be available 24/7
- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- R9: An algorithm allows to recognize license plates involved in a notified violation
- R11: the system has to ask the authorities which parameters to use to filter data
- D1: The information coming from the users is never broken

G8: Cross system's data with those made available by the municipalities

- R12: the system can access the data made available by the municipalities

- R13: the data to be integrated must be made homogeneous (data saved by SafeStreets and data coming from the municipality)
- D10: The data provided by the municipalities are always correct

G9: Allow the municipality to receive suggestions for possible interventions

- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- R14: !!!! (Vedi note)
- D1: The information coming from the users is never broken
- D11: Municipalities are willing to receive suggestions from the system.

G10: Allow users to access to certain stored data (such as the most dangerous roads in a city)

- R1: The system should be available 24/7
- R2: the system offers the possibility to register, with the insertion of e-mail, password and fiscal code
- R4: The system should allow registered users to exploit its features
- R7: The system must save the information about the notified violations
- R8: The system must verify the correctness of the notification made
- D1: The information coming from the users is never broken
- D4: The internet connection works properly without failure on user's device
- D10: The data provided by the municipalities are always correct

3.3 Performance Requirements

3.4 Design Constraints

3.4.1 Standards Compliance

The system must use sensitive data such as location respecting the laws of privacy. The system must in fact require users permission to obtain their location when they take photos to notify a traffic violation. In addition, the email used by customers at the time of registration will not be used for commercial purposes, respecting the law on the protection and privacy of citizens' data, the General Data Protection Regulation.

3.4.2 Hardware Limitations

3.4.3 Any other constraints

3.5 Software System Attributes

3.5.1 Reliability

The system must be able to run continuously without any interruptions, ensuring a 24/7 service. With a single server the desired reliability would not be achievable. For this reason the system must be replicated using multiple servers in parallel. Due to current technological limitations, the algorithm used for reading and recognizing license plates cannot be 100% accurate. For this reason, if the algorithm shows uncertainties about recognition, a SafeStreets operator will have to check the violation and the related photo.

3.5.2 Availability

3.5.3 Security

Customers credentials have to be safely stored. Security of the data and of the communications customer-system is a primary concern. The central database, on which the data will reside, must be protected by all the necessary measures to avoid any external and internal attack. For this reason SafeStreets wants to rely on an industry leader to manage its servers. To send data, encryption technique must be used in order to guarantee privacy and confidentiality.

3.5.4 Maintainability

3.5.5 Portability

4. Formal Analysis

This section includes the Alloy model of some critical aspects of the system. The focus is on some constraints as:

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Moreover, to show the soundness and correctness of the model, a proof of consistency and an example of the generated world are provided.

5. Effort spent

5.1 Fiozzi Davide

TASK	HOURS

5.2 Frantuma Elia

TASK	HOURS

5.3 Freddi Eleonora

TASK	HOURS

6. References

- Slides “RASD”
- Slides “Alloy”
- Slides “Requirements engineering”
- Specification document: “Safe streets Mandatory Project Assignment”

Used Tools

- Alloy Analyzer 5.1.0
- StarUML 3.1.0