

Software Engineering 2

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**SafeStreets**

DD – Design Document

Version 1.0

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# Introduction

## Purpose

### 1.1.1 General Purpose

SafeStreets is a crowded-sourced application that intends to provide users with the possibility to notify authorities when traffic violations occur, specifically parking violations. The application allows users to send pictures of violations, including their date, time, and position, to authorities. The main purpose of SafeStreets is to reduce the number of accidents that may be caused by certain violations that can be avoided easily. The following list may illustrate and visualize the type of violations, according to the traffic regulation and laws10, that may be captured and notified to the authorities:

* Double line parking
* Expiry of the parking time limit
* No parking area
* Parking in places reserved to people with disabilities
* Parking in the middle of bike lanes
* Parking near bus stops
* Parking on crosswalk
* Parking on residents reserved spots
* Parking ticket missing
* Possible vehicles damage by third parties (e.g. broken glass)

SafeStreets stores the information provided by the users, completing it with suitable metadata. When it receives a picture, it runs an algorithm to read the licence plate and stores the retrieved information with the violation, including also the type of violation (input by the user) and the name of the street where the violation occurred (which can be retrieved from the geographical position of the violation). In addition, the application allows both end users and authorities to mine the information that has been received, for example by highlighting the streets (or the areas) with the highest frequency of violations, or the vehicles that commit the most violations. Of course, different levels of visibility are offered to different roles, for example the authorities can see the licence plate numbers of the vehicles that commit any violation while the end user cannot see that.

Moreover, there’s another functionality that can be provided by SafeStreets. If the municipality offers a service that allows users to retrieve the information about accidents that occur on the territory of the municipality, SafeStreets can cross that information with its own data to identify potentially unsafe areas, hence suggest possible interventions depending of the type of the most committed violation in that area. The following examples show which intervention could be suggested depending on the preceding examples of violations presented earlier in this paragraph:

* Add a barrier between the bike lane and the part of the road for motorized vehicles
* Install a towaway zone sign
* Increase parking slots
* Increase local police controls

The main purpose of this functionality is that SafeStreets also identifies areas with critical number of accidents and reports suggestions as a possible solution as an automatized method to engage with the problem. Thus, it could help the authorities to highlight where the interventions should be provided, and this functionality should make it easier to point out the areas with critical statistics. So, if the municipality provide the needed information, it helps with the traceability of the main problem, therefore handling it providing also a higher measurement on local security.

### 1.1.2 Goals

Taking the abstraction as an outcome of the “real-world” only, we should be able to define the goals as a part of the requirement engineering of an S2B to satisfy the stakeholders’ requests:

* [G1] Every registered user should be able to notify violations
* [G2] Every recognized authority should be able to access the application
* [G3] Every recognized authority should be able to receive any violation that has been pointed out by a registered user
* [G4] Every communication from the user must include a violation that has been committed by a recognizable vehicle
* [G5] Every registered end user should be able to mine general information about the violations committed in a certain area
* [G6] Every recognized authority must be able to verify the notified violations by the registered users
* [G7] Every recognized authority must be able to receive suggestions about improving the local security

Reading these goals, we should acknowledge the fact that the system considers two most end users: the normal user and the authorities. They’ll be defined later.

## 1.2 Scope



SafeStreets is meant to help authorities to identify some serious violations, traffic and parking violations, that may cause accidents in the future being. Thus, as it’s been called, it’s intended for making streets safer. Also, this application will increase the efficiency on reporting violations with the help of a common citizen. In order to report a violation, citizens won’t have to go to a police station (that might be far from the current position of the violation), they won’t even have to search where they are in order to report formally the committed violation. There are also some assumptions made in order to satisfy the goals of the S2B and the fundamental requirements that would help the lower level to easily realize the implementation part without considering the research on some tech already defined and available for use, also for higher level perspectives, for future improvements; thus it will be easier to integrate some new tech inherent to the domain of the application.

SafeStreets allow users to report a violation to the authorities when they spot one. In order to obtain the ability of using SafeStreets the user will have to register himself into the application system. Users have two different modes to register themselves into the system: the first one is the proprietary authentication which also requires email validation and the second one consists of SPID9 authentication. Generally, they will have to subscribe with their full name and fiscal code since they’re mandatory to be able to fill certain reports. Registered Users obtain points that indicate their integrity through their continuous voluntary participation in order to provide the possibility of achieving the goal of making the streets safer. These points are called integrity points. Initially, users, who have registered with SPID9, have more integrity points than the proprietary authentication (according to demonstrating more integrity into the society verifying his own identity through a public system of digital authentication). Moreover, when a report is verified by the authorities, integrity points of the notifier increase. Users can see also, through a map, the security level of a zone. Allowing users to mine general information about notified violations doesn’t violate the privacy of the reporting user according to the Legislative Decree 196/031 and the regulation 2016/6793 given since they aren’t authorized to access other users’ private information such as fiscal code, name, surname etc. Security level is calculated being based on the statistics of the types of violations committed in the interested area. Of course, any user will have the possibility to change the password in case it is forgotten through the normal process of password change link sent to their email address.

As it is in the specification of the S2B, Reports are composed of date, time, position, a note (with a maximum fixed number of characters) and a clear picture of the committed violation in which the licence plate should be included, but it isn’t a restricted requirement because, in the worst case, there are two possible situations: in the first one the licence plate isn’t clear (e.g. poor quality or blurry image) the user is allowed to do one out of two possible actions that consist of re-take the picture of the violation or modify the licence plate number, and if the user chooses to do the second action, the system shall recognize the report as one, instead, with a modified licence plate number and this induces minor level of credibility; instead, in the second situation, if the system doesn’t recognize a vehicle in the taken picture it will take an immediate action to discard this picture and it will eventually ask the user to take a new clearer picture to be able to proceed, and that precludes the fact that user might send pictures that are not in accordance with the domain of the application (e.g. photos that don’t contain a vehicle such as selfies).

Since the violation must be notified in real-time domain, the user is not allowed to upload a picture at all. So that, situations as creating a false violation or manipulating data of a certain violation. For the same reason the user is not allowed to modify a photo. If the user notices something that should be mentioned, there’s a note that he can fill in briefly with possible observations. Also, the user must have a stable active connection to be able to submit the violation.

A report should satisfy the application domain before it becomes in hands of authorities and in order to realize this fact a report should include the preconditions described earlier. When a report is filled in completely the authorities must be able to receive it through the application. Within this context, the authorities are defined as Italy’s law enforcement agencies. The authorities, interested in the application willing to use it for increasing local security, must have a valid digital certificate provided by the police forces through the Ministry of the Interior5 and the Ministry of the Defense6. An authority must register making a formal and direct request to the Certified Email7,8 address of SafeStreets through his Certified Email7,8 which will give him in a secure way the credentials generated to be able to use the application or by just using SPID with his Certified Email. The login process with the authority credentials requires also a valid digital certificate. Once an authority is registered and SafeStreets has added his credentials in the system, he will be able to receive notifications about the committed violations. Registered authorities have the maximum authorization to access all the data notified by users. They also have access to all normal user functionalities, thus the capability of reporting violations. The authorities can also verify and validate the visualized reports depending on the veracity of the notified violations. The authorities are also guaranteed a second access to SafeStreets through a web service which require the same login process.

Either the registration process or the reports made and of the user who carried it out are respects the terms established by the Legislative Decree 196/031, Legislative Decree 82/052 and the regulation 2016/6793.

SafeStreets offers also the possibility to be an important participant as an independent entity which can provide suggestions to the improvement of a certain area. In order to realize such a functionality, SafeStreets should have access to accident records of the applied areas. Interested municipalities, in order to let the authorities benefit this functionality, must guarantee access to those data records because it helps the application to cross the provided data about accidents with its own data to provide suitable suggestions depending on the identified situation. It will then notify the authorities regarding those suggestions.

## Definitions, Acronyms, Abbreviations

### Definitions

* **Violation**: a subset of anything that is classified as a traffic violation by the Traffic regulation and laws document. This subset is composed of:
* Double line parking
* Expiry of the parking time limit
* No parking area
* Parking in places reserved to people with disabilities
* Parking in the middle of bike lanes
* Parking near bus stops
* Parking on crosswalk
* Parking on residents reserved spots
* Parking ticket missing
* Possible vehicles damage by third parties (e.g. broken glass)
* **Vehicle**: any terrestrial identifiable vehicle subject to Traffic regulation and laws document, like cars, motorbikes, trucks, etc…
* **User**: any citizen registered in the system who is using any of SafeStreets functionalities.
* **Violation report, notification**: acknowledgment in SafeStreets system of a new violation occurred.
* **Authority**: any registered law enforcement using SafeStreets application alongside its authority-restricted functionalities
* **Municipality**: any central administration of a city or a town which may or may not give open access to its incidents data.
* **Reliability score**: score assigned to any user account which gives a sense of how much a user I reliable in giving information regarding violations.
* **Safe area**: a low radius geographical area where violations are lower than a certain threshold or lower than other areas.
* **Suggestion**: an automatically inferred hint given to the authorities by SafeStreets regarding how they could improve, with the help and permission of their municipality, area marked as high-risk area due to a high correlation of violations and incidents reported from the same municipality. Possible suggestions are:
  + Add a barrier between the bike lane and the part of the road for motorized vehicles
  + Install a towaway zone sign
  + Increase parking slots
  + Increase local police controls
* **Galileo**: Global localization system based on a network of 24 satellites commissioned by European Union and ESA (European Space Agency)
* **SPID**: is the unique system of access with digital identity to the online services of the Italian public administration and of private members: citizens and companies can access services with a unique digital identity in a secured way
* **Certified Email**: A certified email is an email that can only be sent using a special Certified Email Account provided by a registered provider. When a certified email is sent, the sender's provider will release a receipt of the successful (or failed) transaction. This receipt has legal value and it includes precise information about the time the certified email was sent.  A certified email account can only handle certified email and can't be used to send regular email.

### Acronyms

* **API**: Application Programming Interface
* **D.L.**: Legislative Decree
* **DCPM**: Decree of the President of the Council of Ministers of the Italian Republic
* **DD**: Design Document
* **EEA**: European Economic Area
* **EU**: European Union
* **GDPR**: General Data Protection Regulation
* **GPS**: Global Positioning System
* **IEEE**: Institute of Electrical and Electronics Engineers
* **S2B**: Software to Be
* **SPID**: Public Digital Identity System
* **UI**: User Interface

### Abbreviations

• Gn = nth goal

• Dn = nth domain assumption

• Rn = nth requirement

## 1.4 Revision history

* Version 1.0: first release

## 1.5 Reference Documents

* D.L. 196 of 2003 (196/03) <https://www.camera.it/parlam/leggi/deleghe/Testi/03196dl.htm>
* D.L. 82 of 2005 (82/05) <https://docs.italia.it/italia/piano-triennale-ict/codice-amministrazione-digitale-docs/it/v2017-12-13/index.html>
* General Data Protection Regulation (EU) 2016/679 <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016R0679>
* IEEE 830-1998 - IEEE Recommended Practice for Software Requirements Specifications <https://standards.ieee.org/standard/830-1998.html>
* IEEE 29148-2018 - ISO/IEC/IEEE International Standard - Systems and software engineering -- Life cycle processes -- Requirements engineering <https://standards.ieee.org/standard/29148-2018.html>
* Specification document “Mandatory Project Assignment AY 2018-2019” <https://polimi365-my.sharepoint.com/:b:/g/personal/10528029_polimi_it/EXR1gN6gBoxJgMC86Ow45gMBFwZzkRSWuoaf5K7t1wZutA?e=SPnVkI>
* Ministry of the Interior and digital certificates released <http://politichepersonale.interno.it/itaindex.php?IdMat=1&IdSot=35&IdNot=386>
* Ministry of the Defence and digital certificates released <http://www.pkiff.difesa.it/#secEN>
* Certified Email <https://www.agid.gov.it/it/piattaforme/posta-elettronica-certificata>
* Certified Email RFC <https://tools.ietf.org/html/rfc6109>
* SPID <https://www.agid.gov.it/it/piattaforme/spid>
* Traffic regulation and laws <http://www.aci.it/i-servizi/normative/codice-della-strada.html>
* Italian license plate verifier <http://www.targa.co.it/data/doc.aspx>
* Police State license plate verifier <https://www.crimnet.dcpc.interno.gov.it/crimnet/ricerca-targhe-telai-rubati-smarriti/FAQ>
* Alloy documentation <http://alloytools.org/documentation.html>

## 1.6 Document Structure

# Architectural design

## Overview

## Component view

## Deployment view

## Runtime view

## Component interfaces

## 2.6 Selected architectural styles and patterns

## Other design decisions

# User interface design

# Requirements traceability

# Implementation, integration and test plan

# Effort spent

# References