



Cycling Advocacy Requirements Definition

Version 1.0

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Revision History

Date	Version	Description	Author
2019-10-28	0.1	Initial Draft	Boris Vezmar
2019-11-7	0.2	Requirements, use cases and user stories revision	Boris Vezmar, Carlo Casiglia, Dominik Kotarski, Elena Bakuleva
2019-11-08	1.0	Final Version	All members

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1. Introduction

1.1 Purpose of this document

The purpose of this document is to provide an overview of what the Cyclist Advocacy project is supposed to develop, viewed from the user's perspective. In other words, this document defines customer requirements in a manner that ensures a common view of the task to be accomplished, between the development team and the customer. Additionally, this document can both guide development and serve as a quality measure of the resulting product.

1.2 Document organization

The document is organized as follows:

- Section 1, *Introduction*, describes the contents of this guide, the documentation used during developing process, etc.
- Section 2, *Background*, provides the project background information as well as a high-level description of the domain and problem
- Section 3, *Requirements*, defines all core and optional, functional and non-functional project requirements
- Section 4, *Use Cases*, provides two use case diagrams and defines all use cases in detail
- Section 5, *User Stories*, provide a list of user stories, in order to produce an overview of users' requirements in a narrative fashion.

1.3 Intended Audience

The intended audience is:

- The customer
- The project's team
- Project supervisors
- All other project stakeholders

1.4 Scope

The scope of this document includes core and optional, functional and non-functional project requirements. This document provides detailed use cases which define all required product functionalities and behaviors, as well as user stories that clarify how users can interact with the system.

The scope of this document does not include solutions and implementation details such as system architecture, technologies used, low-level implementation details, etc. This document deals more with what needs to be implemented, rather than how to implement it.

1.5 Definitions and acronyms

1.5.1 Definitions

Keyword	Definitions
Functional requirements	Product features or functions that must be implemented to enable users to accomplish their tasks. Features that form the product's functionality.
Non-functional requirements	Describe how the system should behave, as well as constraints on the system's functionality. Criteria that judges the operation of the system. Quality attributes of the system. Some non-functional requirements, such as battery optimization and code quality, are trivial and difficult to measure, so they are implied and not shown here.
Use Cases	Describe all the possible interactions of different actor with the

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	systems, which are handled through previously defined requirements.
User stories	Informal, natural language description of one or more features of a software system, usually written from the perspective of an end-user.

1.5.2 Acronyms and abbreviations

Acronym or abbreviation	Definitions
POLIMI	Politecnico di Milano (Polytechnic University of Milan)
FER	Fakultet elektrotehnike i računarstva (Faculty of Electrical Engineering and Computing)
CFR	Core Functional Requirement
CNFR	Core Non-Functional Requirement
OFR	Optional Functional Requirement
ONFR	Optional Non-Functional Requirement
UC	Use case
US	User story
UUID	Universally unique identifier

1.6 References

- Cyclist's Union: <http://sindikاتبiciklista.hr/en/>
- Fakultet elektrotehnike i računarstva: <https://www.fer.unizg.hr/en>
- Politecnico di Milano: <https://www.polimi.it/en/>
- Bike2Work: <http://www.bike2work-project.eu/en/>

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2. Background

The customer of the project is the Cyclist's Union, a volunteer association founded in 2011 and located in Zagreb, Croatia. Their goal is to promote cycling as an efficient, sustainable and healthy way of transport in order to have clean, safe and pleasant *green* cities.

In accordance with their goal of getting more people to use cycling as a means of transportation, the Cyclist's Union wishes to develop a technological solution for the reporting of road conditions with the goal of monitoring and improvement. More specifically, the solution should be able to detect rough roads and road bumps, collect that information and visualize it. The basic idea is to rely on today's widespread usage of smartphones, namely Android phones, and utilize their various sensors to obtain road surface data. The data obtained by such means can then be analyzed by some algorithm in order to identify road issues like bumps and abrupt breaks, and then used to visualize and locate all potential road issues and encourage local administrations to intervene, which in turn will result in better road conditions that will incentivize people to turn to cycling.

The project team consists of four students from FER and four students from POLIMI, with one supervisor from each university.

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3. Requirements

3.1 Core requirements

3.1.1 Functional requirements

3.1.1.1 Data collection and upload

Using their mobile device, the user should be able to send road condition data to the system service for further processing. After the user has started a trip, and up until they end it, the mobile device should use the device's sensors to collect road condition data and send it to the system service. Additionally, the user's trip route is itself recorded.

ID	CFR-1
NAME	Data collection
RELATES TO	Mobile application
DESCRIPTION	The user should be able to use their mobile device to collect data on road conditions, as well as the trip route data.

ID	CFR-2
NAME	Data upload
RELATES TO	Mobile application
DESCRIPTION	The user should be able to use their mobile device to upload previously collected data to the system service for further processing. This process should initiate automatically if the user's device is connected to the internet using Wi-Fi.

ID	CFR-3
NAME	Data Analysis
RELATES TO	Backend Server
DESCRIPTION	The backend server should perform scheduled analysis over the collected trips' data, in order to identify road issues (on single trips, and also globally), and store them in a database for users' access.

3.1.1.2 Road conditions and issues overview

The user needs to be able to view the current road conditions so that they can plan their travel routes. This information is based on the data collected by the system up to that point and should be represented as a heat map or in some similar manner. In addition, markers for previously reported, current road issues, along with all necessary information, should also be displayed. This display can also be used to present road conditions and issues to local administrations to incentivize road repairs and improvements.

ID	CFR-4
NAME	Road conditions overview
RELATES TO	Mobile application, Web application
DESCRIPTION	The user should be able to use the system interface to review the current road conditions.

ID	CFR-5
NAME	Road issues overview
RELATES TO	Mobile application, Web application
DESCRIPTION	The user should be able to use the system interface to review the current road issues.

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3.1.1.3 User trip management

The user should be able to start and stop their trips. A trip is primarily defined by the route the user took between the trip's start and end point, specified by a collection of geographical coordinates taken during the trip, as well as other relevant trip statistics. Additionally, a trip specifies the time period during which road condition data will be collected by the user's mobile device and sent to the system for further processing and storing. Users can view in detail which data they are collecting, having in mind that this is an advocacy application and users are, in some way, activists so they must be aware of what is going on all the time. They can review their trips along with collected data and, if they choose to do so, they can also get live statistics on the go.

ID	CFR-6
NAME	Trip start
RELATES TO	Mobile application
DESCRIPTION	The user should be able to use the system interface to designate the start of a trip.

ID	CFR-7
NAME	Trip end
RELATES TO	Mobile application
PRECONDITIONS	The user should be able to use the system interface to designate the end of a trip.

ID	CFR-8
NAME	Trips overview
RELATES TO	Mobile application, Web application
PRECONDITIONS	The user should be able to use the system interface to review their previous trips.

ID	CFR-9
NAME	Statistics display
RELATES TO	Mobile application
PRECONDITIONS	During and after trips, the system should display trip statistics to the user

ID	CFR-10
NAME	Screen-off mode
RELATES TO	Mobile application
PRECONDITIONS	During trips, the user should be able to choose to hide the trip statistics being displayed to them; only data collection is performed.

3.1.1.4 User credentials management

The user should be assigned a UUID which would be mapped to the user's trips. The user should be able to provide their UUID in order to view their previous trips. This will provide a sort of anonymous login, which is easier for the users than a traditional login, and will respect their privacy, since no personal and sensitive information is collected.

ID	CFR-11
NAME	UUID generation
RELATES TO	Mobile application
PRECONDITIONS	A UUID should be generated and assigned to the user. This UUID will identify the user's trips.

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3.1.2 Non-functional requirements

ID	CNFR-1
NAME	Android mobile application
RELATES TO	Mobile application
DESCRIPTION	The system's mobile interface must be an Android application.

ID	CNFR-2
NAME	Web interface
RELATES TO	Web application
DESCRIPTION	Along with the mobile interface, the system must provide a web interface used for data visualization, along with other functionalities.

ID	CNFR-3
NAME	System service on a Linux machine
RELATES TO	System
DESCRIPTION	The system's service needs to be deployed on a Linux machine.

ID	CNFR-4
NAME	Caching of collected data
DESCRIPTION	Data collected by the mobile application during trips should be cached and uploaded to the service in bulks to avoid overloading the service.

ID	CNFR-5
NAME	Uploading of data primarily done via Wi-Fi
RELATES TO	Mobile application
DESCRIPTION	Data collected by the mobile application during trips should be uploaded either via Wi-Fi or data connection. If the user is not currently connected to Wi-Fi, the upload will wait until there is a Wi-Fi connection.

ID	CNFR-6
NAME	English language
RELATES TO	Mobile application, Web application
DESCRIPTION	The language used for both the mobile application and web application is English.

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3.2 Optional requirements

3.2.1 Road issue reporting

Two optional modules were proposed for implementation. The first module is integration with Bike2Work, which would involve implementing a Bike2Work campaign tool that manages cyclists and teams, manages ride data, calculates and displays ride statistics and rankings, as well as gamification. The second optional module is the development of an infrastructure issue reporting tool used for reporting road issues through pictures, also integrated with a pre-existing platform called *FixMyStreet*. **Due to time constraints, only the road issue reporting tool module will be implemented.** The user should be able to use their mobile device to take a photograph of a road issue, geo-tag it with the geographical coordinates of the road issue and send it to the system service for further processing.

ID	OFR-1
NAME	Issue reporting
RELATES TO	Mobile application
DESCRIPTION	The user should use their mobile device to report a road issue.

ID	OFR-2
NAME	Integration with FixMyStreet
RELATES TO	System
DESCRIPTION	System should be integrated with the FixMyStreet platform.

3.2.2 User account management

User account management is an optional feature that might potentially be implemented if time constraints allow it and a need for such a feature arises. This would entail account at a more complex level than the simple generated UUID used to identify user's trips. A more complex account system would allow users to manage their information, preferences, settings and similar.

The user needs to be able to register a new account which they can then use to access system functionalities that require such an account. In addition, the user must be able to log onto the system using their account credentials in order to access certain functionalities, as well as log off once they are done using the system. Finally, the user must be able to edit their account information in order to keep the account information up to date.

ID	OFR-3
NAME	User registration
RELATES TO	Mobile application, web application
DESCRIPTION	The user should be able to create and register a new account.

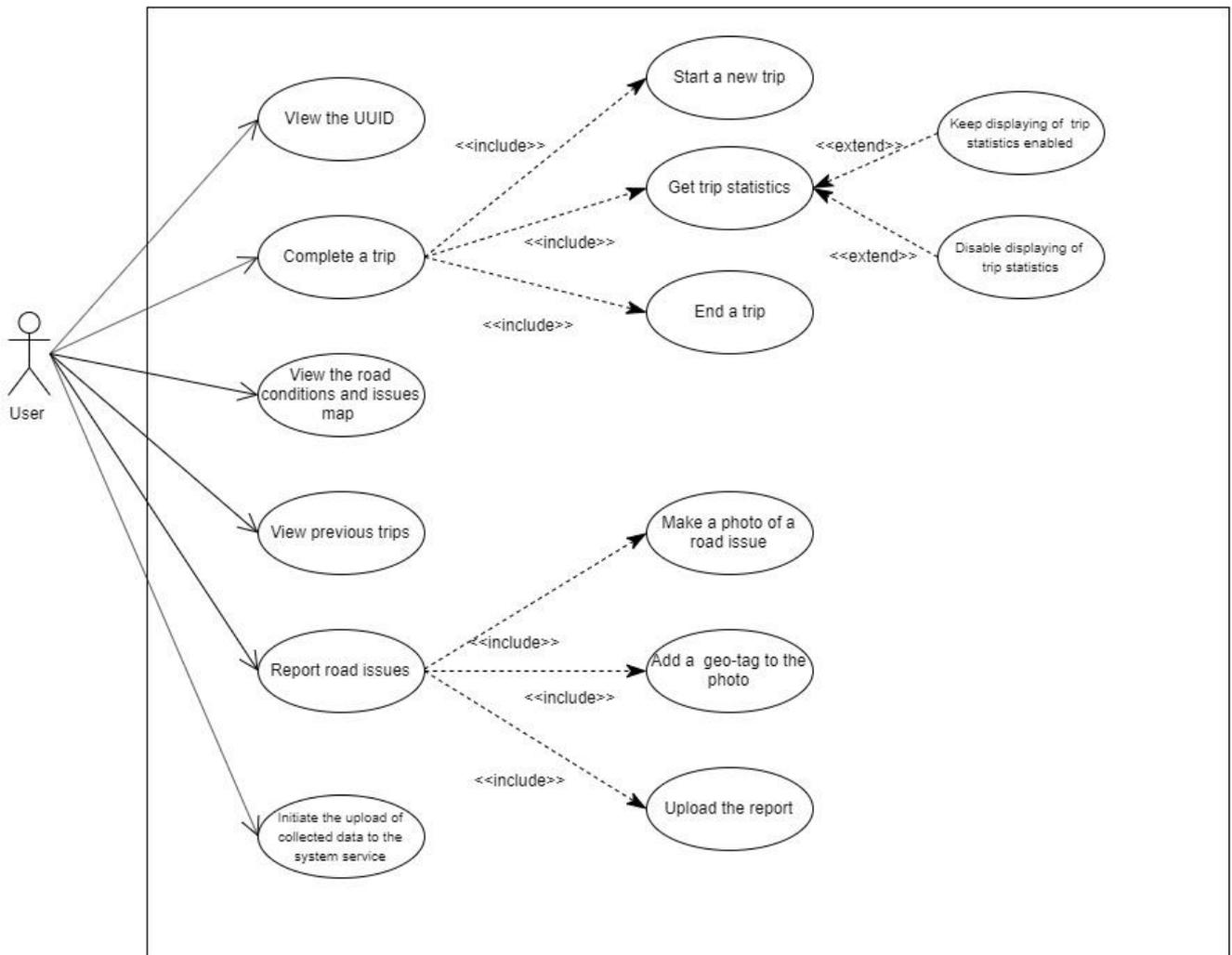
ID	OFR-4
NAME	User login
RELATES TO	Mobile application, web application
DESCRIPTION	The user should be able to log into the system.

ID	OFR-5
NAME	User account editing
RELATES TO	Mobile application, web application
DESCRIPTION	The user should be able to edit their account information.

ID	OFR-6
NAME	User logout
RELATES TO	Mobile application, web application
DESCRIPTION	The user should be able to log out of the system.

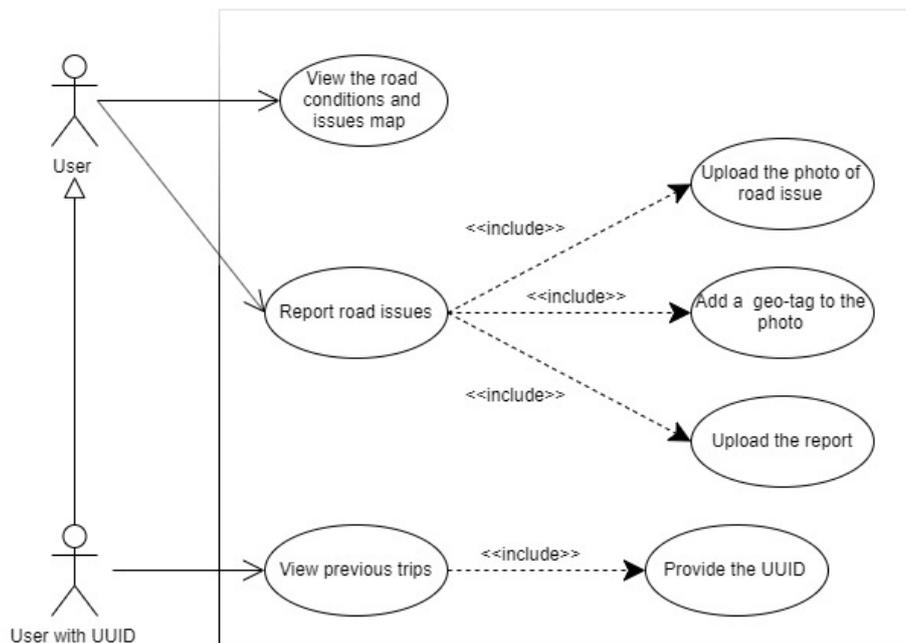
4. Use Cases

4.1 Use case diagrams



Use Case diagram for the Android application

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Use Case diagram for the web version

4.2 Use case table

ID	UC-1
NAME	View the user's UUID
RELATED REQUIREMENTS	CFR-8, CFR-11, CNFR-1, CNFR-2, CNFR-5, OFR-1, OFR-2
PRECONDITIONS	The user has a UUID assigned to them.
DESCRIPTION	<ul style="list-style-type: none"> Using the system interface, the user selects the option to display their assigned UUID The user's UUID is displayed to them
POSTCONDITIONS	The user's UUID is displayed to them

ID	UC-2
NAME	Complete a trip
RELATED REQUIREMENTS	CFR-1, CFR-6, CFR-7, CFR-8, CFR-9, CFR-10, CFR-11, CNFR-1
PRECONDITIONS	User has granted required permissions.
DESCRIPTION	<ul style="list-style-type: none"> Using the system interface, the user selects the option to start a new trip Using the system interface, the user can select the option for disabling the display of trip statistics during the trip The user proceeds to ride their bicycle During the trip, the user's mobile device, attached to the bicycle, collects sensor data, as well as geographical coordinates that define the user's route The collected data is cached and stored on the device During the trip, trip statistics will be displayed to the user unless they disabled this feature using the system interface Once the user reached their destination, they select the option to end the

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	<p>current trip</p> <ul style="list-style-type: none"> • Trip statistics are displayed to the user • Using the system interface, the user can select the option to initiate the upload of collected data to the system service, otherwise this will be done automatically once the device is connected to the internet using Wi-Fi. • Once the data has been uploaded to the system service, it will contribute to the existing data on road conditions and the user's trip will be recorded by the system
POSTCONDITIONS	Data obtained during the user's trip is analyzed, processed and stored by the system.

ID	UC-3
NAME	View the road conditions and issues map
RELATED REQUIREMENTS	CFR-4, CFR-5, CFR-8, ONFR-1, ONFR-2
PRECONDITIONS	None
DESCRIPTION	<ul style="list-style-type: none"> • Using the system interface, the user navigates to the map of road conditions and issues • The map of road conditions and issues is displayed to the user
POSTCONDITIONS	The map of road conditions and issues is displayed to the user.

ID	UC-4
NAME	View the previous trips
RELATED REQUIREMENTS	CFR-8, CNFR-1, CNFR-2
PRECONDITIONS	The user has a generated UUID assigned to them.
DESCRIPTION	<ul style="list-style-type: none"> • Using the system interface, the user selects the option of displaying their previous trips • The system asks the user to input the UUID that was assigned to them • The user inputs the UUID that was assigned to them • The system interface displays the users previous trips, along with other relevant information
POSTCONDITIONS	The user's previous trips are displayed to the user

ID	UC-5
NAME	Report road issues
RELATED REQUIREMENTS	OFR-1, OFR-2
PRECONDITIONS	None
DESCRIPTION	<ul style="list-style-type: none"> • Using their mobile device, the user photographs a road issue they encountered • The user geo-tags the photograph with the geographical coordinates of the road issue • The user uploads the issue report to the system service • The system processes and records the reported road issue
POSTCONDITIONS	The issue reported by the user is processed and recorded

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5. User stories

ID	US-1
RELATED REQUIREMENTS	CFR-4, CFR-5, CFR-6, CFR-7, CFR-8, CNFR-1, CNFR-2
STORY	As a user, I want to track my cycling trip so that I can see details about my trip both during the trip and after the trip.

ID	US-2
RELATED REQUIREMENTS	CFR-8, CFR-9, CNFR-1, CNFR-2
STORY	As a user, I want to examine the current road conditions and potential road issues so that I can plan my travel route.

ID	US-5
RELATED REQUIREMENTS	CFR-1, CFR-2, CFR-3, CFR-4, CFR-5, CFR-8, CFR-9, OFR-1, OFR-2
STORY	As a user, I want the app to be transparent about its purpose and to feel like I'm really helping, since I'm using it for activism.

ID	US-6
RELATED REQUIREMENTS	CFR-10, CNFR-1
STORY	As a user, I want to be able to turn features off so that I can save my battery.

ID	US-3
RELATED REQUIREMENTS	OFR-1, OFR-2
STORY	As a user I want to report road issues so that I can help fellow cyclists.

ID	US-4
RELATED REQUIREMENTS	CFR-1, CFR-2, CFR-3, OFR-1, OFR-2
STORY	As the Cyclist's Union I want to collect road condition and road issue data so that I can present it to relevant local authorities and incentivize road repairs and improvements.