POLITECNICO
MILANO 1863

RoadFix project by Haakon Flaten - Paal Kjekstad

Requirement Analysis and Specification Document

Deliverable:	RASD
Title:	Requirement Analysis and Verification Document
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Version:	2.1
Date:	25-May-2021
Download page:	GitHub repository
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1 Introduction

1.1 Purpose

The aim for the Requirement Analysis and Specification Document (RASD) is to make it easier to understand the interactions between the user and software.
Description of the requirements, both functional and non-functional, all scenarios and actions between the program and user will be discussed.
The persons who will go through the document is the software developers, asphalt contractors and road owners.

1.2 Scope

RoadFix will be a web application that makes the roads better by letting the road owners know where to allocate the resources in the most efficient way. In Epicollect5, data about potholes is stored and that information will be available for the road owners.

The idea is that damaged roads used by the most people, will get more reported damages than less used roads. Furthermore, this will increase the decision base for the road owners and help them allocate the resources where it is most needed. This in turn, will be socio-economically favourable, and that is the main goal of the program.

1.3 Definitions, acronyms and abbreviations

Clarifications of essential definitions, acronyms and abbreviations

1.3.1 Definitions

- Asphalt constructor: The contractor who fixes the road
- Road Owners: The responsible part of the road, for example private shareholders, government, etc.
- Program: The RoadFix program is referred to as program
- Pothole: Damage on the road related to vehicles
- App: Application

1.3.2 Acronyms

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

1.3.3 Abbreviations

No abbreviations were used other than acronyms.

1.4 Revision history

14.04.2021 - First writings in Latex 28.04.2021 - Improvements on the corrections from last version 25.05.2021 - Some changes

1.5 Reference Document

The assignment document: AY20-21 Project.pdf

2 Overall Description

2.1 Product description

The program in development is aimed to help the road owners to get a more efficient flow of information and give the road owners more knowledge on the state of the roads. The data used in this application will be taken from Epicollect5. The dataset in focus is a 190 element document with nine attributes including geographical coordinates. The Epicollect5 project has its origin in the streets of London. All the 190 elements will be processed by the road owner. The damage will be rated by the operator of the app as explained below. When the damage has been rated it will be added to the map as a point.

The user will rate the damages from 1 to 10. Where 10 is a critical damage and 1 is a minor damage. Damages rated between 1-3 will be colored yellow on the map. Damages rated between 4-7 will be colored orange. Damages rated between 8-10 will be colored red. This visualises the condition of the roads in a good way because it is easy to see where it is most damages. The picture below, figure 1, is a concept drawing of how the design of the map could look like in the program.

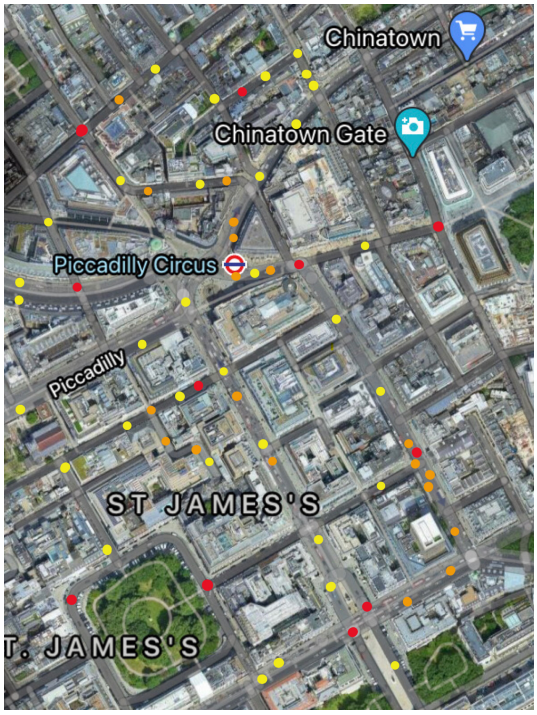

Figure 1: concept drawing of the map

For the user to be able to use the program, they need to make a user account. The program will remember the account so it will be easy to login when used again. The user will also be able to logout of the program when this is needed.

The user will be able to change the rating of a damage. This will in most cases be done when the road has been fixed. The rating of a damage will change from the original rating to fixed. So instead of having a rating between 1 and 10, the damages will be registered as fixed. The fixed damage will then disappear from the map, because the damages are no longer on the roads.

2.2 Functions

The functions of the program will be as few and easy as possible to obtain a simple and user friendly interface. The functions the program needs are:

- Take in the information from Epicollect5
- Possibility for the road owner to rate the damages
- Visualize the damages on a map with correct color and position
- Have the possibility to change and remove the rating of the damages

2.3 User Characteristics

The users have to possess a basic level of knowledge regarding computer use. It requires that the user can navigate to a web site and be able to download the files needed. They also need to have knowledge of how to rate the damages on the road.

The user of the program is the road owners and the asphalt contractors. They will be able to work with information on the app and use it to keep day-to-day track of the work that's been done. That makes it easier for both parts to communicate during the progress.

2.4 Goals

The goal of RoadFix is to make it easier for the road owners to maintain the road.

2.5 Domain Assumptions

In order to let the program work, some assumptions are made:

- Every picture has a GPS-coordinate
- The GPS-coordinate have an error that is no more than $1m$
- The user have internet connection when using the application
- Pictures needs to be interpreted correct by the user. A picture that should have a rating of 3, is rated 3.

3 Relevant Phenomena

3.1 The World

Requirement engineering is concerned with phenomena occurring in the World. The World is defined as the portion of the real world that the Machine can influence. For the RoadFix program, this is some World phenomena:

- Occurrence of damaged roads
- Taking picture of the road
- Reduction of asphalt supply
- Asphalt contractors repairing the road

3.2 The Machine

On the other hand, some phenomena occurs inside the Machine. This is the portion of the system to be developed, and this are some examples:

- Storage of new information
- Interpreting the GPS-coordinate
- Positioning damages on a map

3.3 Shared Phenomena

Some phenomena are shared between the Machine and the World, and this is how they are connected. Here are some examples of shared phenomena controlled by the machine and observed by the world:

- The color of a damage. The user rates a picture and the program gives the color
- The pictures given to the user. The program decides which picture the user is given and the user have to rate that picture

Phenomena controlled by the world and observed by the machine:

- Log in to RoadFix
- The registering of new users to RoadFix
- Rating a picture
- Updating road condition status

4 Requirements

4.1 Functional Requirements

For the program to work as planed it needs to describe the interactions between the system and the environment independent from implementation. The program needs to be able to:

- Register a user
- Log in with a unique user
- Save the information a user has made
- Take in information from Epicollect5
- Let the user rate pictures consecutively
- Let the user change the rating of a damage
- Log out from a user
- Save a map and create colored points on the map where there are damages
- Update the map

4.2 Nonfunctional Requirements

Requirements that are not directly connected to the functional behavior of the program. Some examples:

- Enough storage limit in the program
- The time to update the map needs to be within 30 seconds
- The system should be available 24/7

4.3 Interacting software/hardware

4.3.1 Hardware Interface

Operating the program is easiest through a personal computer with a web browser that is connected to the Internet.

4.3.2 Software Interface

Web browsers that should be supported is Google Chrome, Safari, Internet Explorer, Opera, Firefox.

5 Use cases

5.1 Scenario 1

Charles access his computer when arriving at work. He does not have a user at RoadFix, so he needs to make a user. When he goes to the arrival page of RoadFix he gets a option to login or register a new user. In Charles's case he will make a new user. By typing in username and password he gets a user with access to RoadFix. The program will take Charles to the login page.

Use case

Register user.

Actors

- Employee: works at the road owner company, Charles in the scenario.

Entry condition

A user is available.

Flow of events

Charles starts of by:

- Going to RoadFix
- Register a new user

Exit condition

Charles has made a user account.

Exceptions

Charles may type in an existing username. In that case, the program needs to give him a message. A message could be: "Your chosen username is already taken. Choose another."

5.2 Scenario 2

Frank wants to login to RoadFix. He has already registered a user. He goes to the arrival page of RoadFix. The page asks if he wants to login or register a user. Frank wants to login. He enters his username and password and gets redirected to the home page of the app.

Use case

Login case.

Actors

- Employee: Works for the road owners. Frank in this scenario.

Entry condition

Frank has a user.

Flow of events

Frank starts of by:

- Going to RoadFix
- Logs in with his username and password
- The app redirect him to the home page

Exit condition

Frank has logged in.

Exceptions

- Typing in wrong username
- Typing in wrong password

RoadFix will give Frank a message on what the problem is and how to fix it. A possible error message could be: The username/password you have typed in is not registered in our database. Please try again or register a new user.

5.3 Scenario 3

Tiffany has been working in RoadFix. She is done with her work for today. Therefore she wants to log out of the app. She presses the button in the top right corner of the app. The button is in the navigation bar. The app redirect her to the "login" page.

Use case

Logout case.

Actors

- Employee: Works for the road owners. Tiffany in this scenario.

Entry condition

Tiffany has a user that is logged in at the point in time she decides to log out.

Flow of events

The road owner starts of by:

- Deciding that the work is done for the day
- Presses the log out button
- The app redirect here to the log in page

Exit condition

Road owner has logged out.

Exceptions

It should not be possible to make a mistake in this scenario.

5.4 Scenario 4

Tiffany is at work and wants to rate a damage. She is logged in and goes to the page "workspace". In the workspace she presses the hyperlink that directs her to a picture of a damage. She rates the picture. After looking at the damage she goes back to the workspace and submit a rating of 3. A message shows her "Rating successful".

Use case

Rate damage

Actors

- Road owner: Responsible for the road, Tiffany in the scenario

Entry condition

The road owner starts rating a picture

Flow of events

The road owner starts of by:

- Entering the workspace
- Pressing the hyperlink to the damage
- Gives the picture a rating of 3

Exit condition

The workspace updates after the damage is rated

Exceptions

- A damage is rated less than 1 or more than 10. A message is flashed and tells the user that the rating must be between 1-10.

5.5 Scenario 5

Tiffany wants to rate a damage. She rates 3 damages. Damage-1 get a rating 3, damage-2 get a rating 6 and damage-3 get a rating 10. The program will give damage-1 color yellow, damage-2 color orange and damage-3 color red. This will be visualised on the map as described in the product description 2.1.

Use case

Coloring of damage

Actors

- Road owner: Responsible for the road, Tiffany in the scenario

Entry condition

Road owner starts rating the damages.

Flow of events

- Road owner rates 3 pictures of damages, which is given rating:
  - Damage-1 has a rating 3
  - Damage-2 has a rating 6
  - Damage-3 has a rating 10
- The program registers the rating and stores it
- The app visualises the lists on the map according to the system mentioned in 2.1

Exit condition

Tiffany stops working.

5.6 Scenario 6

Tiffany wants to remove some damages from RoadFix. On the home page, under the map, is a list of all the damages that has been rated. She presses the edit button next to the text the damage she wants to remove and sets the damage to fixed.

Use case

Remove rating.

Actors

Road owner: Responsible for the road. Tiffany in the scenario.

Entry condition

The road has been fixed.

Flow of events

- The road has been fixed
- The road owner logs into RoadFix
- The road owner navigates to the home page
- The road owner find the damage that needs removing
- The road owner presses edit rated damage
- The program takes the user to the update page
- The road owner changes the status of the damage from the original rating to "fixed damage"
- The program changes the status of the damages and updates the map

Exit condition

When road owner has changed the status of the damage to fixed, then the map updates.

Exceptions

All changes to the status of the damages from a normal rating to a "fixed damage" is irreversible.

5.7 Scenario 7

Tiffany, an employee in the road owner company wants to check how the conditions on the roads are. She logs into RoadFix and goes on to the page called "workspace". There she finds pictures of different damages on the roads in England. She then starts to rate the damages on the roads based on the picture from Epicollect5. After rating a pictures 7 the program change the color of that damage to orange on the map, according to the rating system as explained in 5.4. Tiffany looks at the map every once in a while, and when she notice that a part of the map has a lot of orange and red damages, she contacts Axl on the phone. Axl is an employee at the asphalt contractor company, and he confirms that the message is received.

Use case

Road Owner.

Actors

- Road owner: Responsible for the road, Tiffany in the scenario
- Project engineer: Resource allocator in the asphalt construction company, Axl in the scenario

Entry condition

True, a picture is always available for review.

Flow of events

- The owner starts working and logs into RoadFix
- The owner goes to the workspace page on RoadFix
- The owner opens the first picture
- RoadFix answers with giving the owner a form
- The Owner rates the picture from 1-10, and submit
- RoadFix then updates the information and stores it
- The owner looks at the map and evaluate where to allocate the resources
- The owner contacts the project engineer and tells him that one area needs to be fixed
- The project engineer receives and confirm the message

Exit condition

The project engineer has received and confirmed the message.

Exceptions

- If there are no more pictures from Epicollect5 and all the damages is fixed, it will not be more work to do for the road owner or the asphalt contractor.

Special requirements

- The calculation time of the program is less than 30 seconds

5.8 Scenario 8

Axl is called by Tiffany and told that a specific part of the map needs to be fixed. He logs into RoadFix and goes to the page "home". He then finds the area that Tiffany told him to fix. He looks at the weekly schedule plan and notice that a team of constructors are finished in 2 hours. He notify Karol, the boss of the constructors, and informs him about the new task they have in 2 hours. When the road is eventually fixed, Axl changes the status for the damages to "repaired damage".

Use case

Asphalt contractor

Actors

- Road owner: Responsible for the road, Tiffany in the scenario
- Project engineer: Resource allocator in the asphalt construction company, Axl in the scenario
- Chief constructor: The leader for the asphalt constructor team, Karol in the scenario

Entry condition

An asphalt constructor team is always available within a reasonable time.

Flow of events

- The project engineer is called by the owner and told that a area on the map needs fixing
- The project engineer finds the area on RoadFix
- The report is acknowledged and allocating of resources starts
- The first constructor chief is available in 2 hours
- The project engineer gives the location to the constructor chief and tells them to be there in 2 hours
- When finished, the project engineer change the status of the damage in RoadFix

Exit condition

The project engineer has changed the report in RoadFix and the app removes the damages from the map.

Exceptions

- A work team is not available in reasonable time, the project engineer calls the road owner
- If the report from the road owner says that it is a lot of damages in one area, the project engineer needs to allocate resources in less than 30 minutes

6 Appendix

7 Software used

- Overleaf as an editor for Latex

8 Effort

Both have used the same amount of work and have helped each other with all sections. There is no point to specify hours spent on each activity since our work overlaps.

- Paal Kjekstad: 20 hours
- Haakon Flaten: 20 hours

References

