Requirement Analysis and Specifications Document

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Introduction

Purpose

This is the Requirement Analysis and Specifications Document which will be used in the design and implementation of the software **Coco Cumbi**.

The purpose of this document is, therefore, to describe the requirements, specifications, domain assumptions, use cases and constraints of the software to be implemented.

We hereby define the intended audience of this document as:

- The **Client**: Public Administration of the Province of Pichincha, from here on now referred to as *PA* or *the client*.

- The **Project Manager** of the team, from here on now referred to as *PM*.

- The **Developers** and the **Testing Team**

- The **End Users**, i.e., the employees of the PA in question, from here on now referred to as *users*

The purpose of our project is to help the client, who is the PA of the province of Pichincha in Ecuador, make and implement policies supporting its many activities dedicated to the forestation and reforestation of its territory, through a desktop application.

The software will use data coming from a forest census of the Canton of Ruminahui, which represents trees as georeferenced points in the area of study.

Goals of the Application

Our client is the PA of a largely populated province, who needs a software able to help them in analysing forest data for their many policies and activities in the environmental sector, specifically in the (re)forestation of the Canton Ruminahui.

The information system must be a tool capable of accessing, retrieving, visualizing, and analyzing data coming from the forest census of the area, with the help of mapping tools.

The main goal is to allow density and characteristics analysis on the different species of trees, to analyze areas where it would be more appropriate to focus reforestation efforts or implement policies, events or activities for the general population to incentivize the repopulation of certain kinds of endangered species of the region (e.g., Araucaria, Coco Cumbi, etc.).

Therefore, the client has requested the provider (from here on now: *we/us*) to design and implement a software application, by the name of:

Coco Cumbi

with the main objective of helping in the decision-making processes and policy building of the PA.

Scope

This software is intended for the management of a specific type of data, containing attributes referred on different species of trees. It can be extended to every other dataset that satisfies this domain. The scope of the application is decision-making through geographical-based computations and statistics.

In order to better guide us in the analysis of the Requirements and Use Cases that are presented in the next paragraphs, we will introduce and

discuss the different events that can happen in either the ***real world*** (portion of it affected by the machine), the ***machine*** (software to-be and hardware), or a ***shared environment***.

World: presence of different species of trees, density of each species, PA (re)forestation plan;

Shared: data collection, data query, user registering in the application, user logging in and out, user accessing data, user downloading data;

Machine: computation of statistics, visualization of the results, data storing.

Users and Interfaces of the Application

The software application system is designed to interact with PA employees only. Therefore, there is only one interface we need to implement and provide, for a desktop web application.

The system will receive data from a regularly updated tree census. It will be able to retrieve data, visualize the distribution of said data and help the decision-making through the implementation of useful statistics and metrics made by the end users, based on queries.

The software will provide these metrics with the help of different statistical tools based on the data uploaded by the system from the census.

Dataset Description

The dataset comes from a tree census found on Epicollect5.

As stated in paragraph", it entails georeferenced data coming from the Canton Ruminahui in the Pichincha province of Ecuador.

In the following table the main information found in this dataset are summarized.

Parameters	Descriptions
Numeric tree ID	An integer indicating the tree identificator, every ID is unique
Date	the date on which the corresponding tree was sampled.
Census Area ID	An integer indicating the the area to which the tree belongs, every area has a unique ID
Group	/
Common Name	The name commonly used to refer to a specific type of tree
Scientific Name	/
Tree status indicator	An indication of the tree health status. Ex: Acceptable, Medium...
Coordinates	/
Written coordinates	/
DBH	Tree diameter at breast height
Height	Height of the specimen
Crown diameter	Diameter (in m) of the crown of the specimen
Crown radius	Radius (in cm) of the crown of the specimen
Sector	/
Property	Private or Public
Risk	Risk factor associated with the tree location such as inclined stem

Definitions, Acronyms and Abbreviations

Find here an updated list of commonly used and referenced acronyms and abbreviations found in the document; also find some definitions of terms that might not be common knowledge to some of the intended audiences of this document.

Terms	Descriptions
ID	Identifier
System	The application we are designing
DBH	Diameter at Breast Height
User	A person who utilizes a computer or network service
User authentication	A security process which ensures that a user cannot access another user's profile if not in possess of their credentials
Queries	A request for data or information from the Database
Georeferenced data	Data tied to a known Earth coordinate system
PA	Public Administration of the Province of Pichincha
PM	Project manager of the team
GPS	Global Positioning System
We/us	The development team

Overall Description

The software application is only developed in its desktop version, since the purpose of it is to be principally used in an office setting on day-to-day activities and reports. This web application will not be made available for the general public, but only to users established by the PA, prior authorization and upon request.

The web application will be made available and must operate on the main existing browsers (i.e., Google Chrome, Safari, Microsoft Edge, and Mozilla Firefox).

In order to better exemplify the use of the application **Coco Cumbi**, we introduce a plausible scenario. In said scenario, the day-to-day use of the software application will be shown from the perspective of an auxiliary PA employee, Tom.

Scenario

Tom is a PA employee, and he oversees the research and extraction of useful information for the purpose of supporting the decision-making stage of an operation involving reforestation processes.

Firstly, Tom must register and subsequently log into the web application through an authorized e-mail address. Once logged in, Tom can choose between different functionalities:

- view and modify his personal information
- start a query using predefined filters
- perform predefined operations on the whole dataset, or on a section of it, to obtain information such as indices on biodiversity, average height, etc.

Eventually, Tom can see the results of his operations and queries represented in maps, graphs, and tables. He can now export these results and information, which will help in supporting the decision-making process.

Use Cases

Case 1 – Registration

Actors: user

Entry condition: the user starts the web application and clicks on the sign-up button.

Flow of events:

- the user fills in the form with their credentials. Among those, the mandatory ones are:
    - Name
    - Surname
    - Email
    - Password
    - Password Confirmation
- the system checks if the email comes from an authorized address
- the system checks if the object in the "Password" field is valid
- the system checks if the elements in the "Password" and "Password Confirmation" fields are the same
- the system checks for the presence of the e-mail address in the list of existing accounts
- if the address is not present in the list, the system saves the new account in the list of existing account and logs in automatically

Exit conditions:

- the user has successfully registered their account in the web application

-   the user wants to abort the operation

Exceptions:

-   the user inserts an e-mail address already associated with an existing account, the system shows an alert and navigates back to the form page
-   the user email comes from an unauthorized address, the system shows an alert
-   the user inserts in the "Password" field an invalid password, the system shows an alert
-   the user inserts different objects in the "Password" and "Confirmation Password" fields, the system shows an alert and ask the user to insert again the credentials

Special requirements: The saving of the newly created account lasts no longer than 30 seconds

Case 2 – Login

Actors: user

Entry condition: the user has connected to the login page

Flow of events:

-   the user inserts its credentials:
    -   E-mail
    -   Password
-   the system checks the correctness of the credentials inserted
-   the system redirects the user to its personal page/home page of the web application

Exit condition: the user has logged in

Exceptions:

- the user inserts wrong credentials, the page informs the user
- the user doesn't have an account, the page asks the user if wants to register

Special requirements: the authentication lasts no longer than 30 seconds

Case 3 - Home Page Navigation

Actors: user

Entry condition: the user has successfully logged-in

Flow of events:

- the user can browse in the home page and select an option among the following ones:
  - view information about personal profile
  - view information about dataset (status, numerosity, last update date)
  - access to saved results
  - start a new query
  - access directly to the interactive map

Exit condition: the user select an option, the system navigates to the corresponding page

Exceptions: none

Special requirements: user login must be successful

Case 4 - Data Request/Query

Actors: user, dataset

Entry condition: in the home page, the user selects the query option

Flow of events:

- the user can select filters from the following:
    - all data
    - scientific name (string)
    - census zone index (list/int)
    - group index (list/int)
    - surveying area with a range of coordinates (two values for latitude and two values for longitude)
    - insert specific coordinates (two int value)
    - choose a coordinate buffer (int, default 15m)
    - range of heights in meters (two float values)
    - range of DAP in centimeters(two float values)
    - range of tree crown diameter in meters(two float values)
    - condition of the tree(list)
    - risk(list/string)
    - property(list)
    - sector(list/string)
- user can also select a function to be applied from a set (e.g.: show highest/lowest value for a certain attribute), and combine it with filters (ex: show highest tree in a certain area)
- the system checks if the coordinates are acceptable
- once the filters and functions are set, the user selects the "show results" option
- the web application connects to the dataset and selects the data that satisfies the filters and apply the function entered by the user
- the web application saves temporarily the results and navigate to the results page

Exit condition: the web application ends the search and collection of the requested data

Exceptions:

- there are no results that satisfy the request, the page informs the user with an alert

- the coordinates inserted are not acceptable (the coordinates do not correspond to any point on the domain surface), the page informs the user with an alert
- It is unable to establish a connection, the page informs the user with an alert
- the connection is lost, the page informs the user with an alert

Special requirements:

- the minimum buffer is of 15 meters
- connection to the dataset

Case 5 - Personal Profile

Actors: user

Entry condition: in the home page, the user select the "Personal Profile" option

Flow of events:

- the user profile data are shown
- the user can select the "update your profile data" option
- the system asks the user to insert their password
- the system checks the correctness of the password
- the user inserts their new credentials, among the following ones:
    - Name
    - Surname
    - Email
    - New Password
    - New Password Confirmation
- the system checks if the email comes from an authorized address
- the system checks if the object in the "Password" field is valid
- the system checks if the elements in the "Password" and "Confirmation Password" fields are the same
- the system checks for the presence of the e-mail address in the list of existing account

Exit condition:

- the user clicks on the "Exit" button
- the user has successfully changed his account information

Exceptions:

- the user inserts an e-mail address already associated with an existing account, the system shows an alert and navigates back to the form page
- the user email comes from an unauthorized address, the system shows an alert
- the inserted password is not correct, the system informs the user with an alert and ask him again the password
- the user inserts an object in the "Password" field an invalid password, the system shows an alert
- the user inserts different objects in the "Password" and "Confirmation Password" fields, the system shows an alert and ask the user to insert again the credentials

Special requirements:

- Saving the new account credentials takes no longer than 30 seconds

Case 6 - Log-out

Actors: user

Entry condition: the user has successfully logged in

Flow of events:

- the user clicks the "Logout" button
- the system asks the user to confirm his choice
- the system redirects the user to the "Login page"

Exit condition:

- the user has logged out
- the user rejects the choice

Exceptions: none

Special requirements: the logout procedure lasts no longer than 30 seconds.

Case 7 - Results Representation

Actors: user

Entry conditions: the web application has successfully completed the search and collection stage with the filters selected by the user

Flow of events:

- the user can select the type of results visualization between interactive map, graphs, data visualization
- if user selected data visualization, they view results as a list of objects with attributes
- if user selected map visualization, they can interact with the map, changing the attributes to be displayed among those present in the dataset

Exit conditions:

- the user selects to exit after the results visualization
- the user selects the option for a new query
- an error occurs loading a map or a graph

Exceptions:

- there are no results to show for the requested query, the system informs the user with an alert
- there is an error loading map or graph, the system informs the user with an alert

Special requirements: there are results available for the requested query and for the selected type of representation

Case 8 - Interactive Map

Actors: user

Entry condition: user select the interactive map option in the home page or in the results page

Flow of events:

- user can interact through an interface by selecting different filters and attributes to show
- the system shows the results on a map

Exit condition: user select exit option

Exceptions: there are no results that satisfy the request, the page informs the user with an alert

Special requirements: connection to the dataset

Case 9 – Download of Results

Actors: user

Entry conditions:

- the web application has successfully completed the search and collection stage with filters selected by the user
- the result representation tool has successfully completed the search and collection stage with filters selected by the user

Flow of events:

- the user clicks on the "Download" button
- the system prepare the file to be downloaded with the correct extension
- the system shows a preview of the results and ask the user to confirm their choice

Exit conditions:

- the file is downloaded correctly
- the user refuse the confirmation, the download procedure is aborted

Exceptions: if there is an error downloading the file, the system informs the user with an alert

Special requirements:

- the preparation of the file lasts no more than 5 seconds/Mb
- free available space on the hard disk

Requirements

In this section, we will divide our main requirements into *functional* and *non-functional.*

Functional Requirements:

- The system should allow users to visualize data and query results on an interactive map
- The system should allow users to make analysis on the data
- The system should allow sign up only to authorized users (e.g., PA employees with an e-mail address domain @publicadmindomain.it)
- The system must allow user registration
- The system must allow user authentication
- The system must allow user to visualize data on an interactive map
- The system must allow authenticated users to make queries on data
- The system must allow user to download results as maps or graphs

- The system must guarantee multiple users to access it concurrently
- The system must be able to perform statistical calculations on georeferenced data, providing metrics in return.

Non-Functional Requirements:

- The software must be available 24h per day
- The system must provide feedback in 30 seconds
- The system must be able to connect to the dataset
- The system should update tree census data every day
- The system should be implemented in English

Domain Assumptions

- For every data request, the most recent data is intended to be retrieved
- For every request, the correct location is encoded
- For all the data uploaded, details are correctly entered
- Each user has a computer with the minimum requirements to run the software system
- Each user is a PA employee, as such, they will have the correct email domain to guarantee authorization, authentication, and access to the software
- Users can correctly use filters to analyze data
- Users can correctly interpret data metrics and statistics without further instructions
- Accurate locations of tree specimens are known by their GPS positions
- Coordinate overlaps always refer to different tree specimens, and they are due to accuracy of GPS receivers

Effort Spent

The effort spent in the drafting of this document was equally shared between the team members, both in time and in section topic.

As such, it is thusly divided:

Team Member:	Amount of Hours Worked:
Stefano **Brazzoli**	7
Martina Giovanna **Esposito**	7
Mattia **Koren**	7
Gaia **Vallarino**	7
TOTALE	**28**

Bibliography

Elisabetta Di Nitto, *Software Engineering for Geoinformatics – Slides*, 2022

Details & Update Log

DETAILS

DELIVERABLE	RASD
TITLE	Requirement Analysis and Verification Document
SOFTWARE NAME	Coco Cumbi
AUTHORS	Brazzoli S., Esposito M.G., Koren M., Vallarino G.
VERSION	1.0
DATE	April 20th, 2022
DOWNLOAD PAGE	github.com/gaiavallarino/SE4GI
COPYRIGHT	Copyright © 2022, Brazzoli S., Esposito M.G., Koren M., Vallarino G. – All rights reserved

UPDATE LOG

Version	Date	Description
1.0	Apr 20th, 2022	First draft and submission