



Requirement Analysis and Verification Document

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Revision History

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Project Scope and Goals

The aim of the project is to show to the Users informations about the biodiversity of the city of Winamac, Pulaski county, Indiana, and the ecological aspects that emerged by the processing of the collected data, providing a map of the green areas of the city; finally, using the dendrometric measurements carried out, put in evidence which are the species that have better adapted and have found an ideal habitat in that territory.

Users want to visualize data processing that gives environmental information regarding the protection of the species and pollution, to have the possibility to retrieve raw data and to contribute to the collection on the territory to expand and enrich the database.

Goal of the project is to identify the sectors of the city where there is greater evidence of pollution (acid rain, heavy metal pollution, imported pathogens) and anthropogenic impact (physical damage, such as from pruning), so as to map the areas of the city with the highest phytoecological balance.

Domain Analysis

The Users of the software we are developing are:

- Inhabitants that want to know the location of the green areas of their city.
- Associations for environmental and landscape protection that want to encourage local authorities and communities to protect the natural heritage of the urban areas.
- Users with scientific and cultural dissemination purpose.
- Statistical Research Institutes that aim to draw up rankings, based on the biodiversity of each city of the Indiana state.
- Botanical Research Centres that want to verify the real presence of specific species in the analysed area and check its health conditions.
- Companies wishing to apply for buildings concessions and who require accurate information regarding the undeveloped spaces of the city.

The software is implemented in an Anaconda environment; it performs a REST API JSON data request to the services of Epicollect5 platform, the raw data collected on field through the Epicollect5 application are processed in the project.

Flask and Bokeh libraries are used to create static, interactive and dynamic plots running on a web browser, useful to give the Users a wide range of options and tools for manipulate and visualize the data.

Relevant Phenomena

Once having clarified the project's scope and goals and having analysed the domain, is important to focus on the phenomena that occurs in our horizon.

We have decided to analyse the phenomena by using "The World and the Machine Approach", by M. Jackson and P. Zave.

With "World" we intend the environment on which the analysis is done, in this particular case we intend the concrete entities on which the measurements are done: the trees of Winamac City (Indiana State, USA).

Moreover, with the world "Machine" we intend the system that we're going to develop, in this case a Web Application.

This method is based on the distinction of the phenomena that occur in the world, in the machine and the phenomena that are shared. In particular, the shared phenomena must be distinguished between phenomena that are controlled by the world and observed by the machine and phenomena that are controlled by the machine and observed by the world.

In this particular case the shared phenomena controlled by the world and observed by the machine are the attributes of the collected of field data that the software aims to process in such a way that the user will be able to visualize them in a map, extract customized view of them and get statistical information about the data by interactive graphs and histograms. In addition, it will be able for the users to upload data.

World Phenomena

- Not registered trees
- New born trees
- Conditions of the trees after the collection the information about it

Shared Phenomena

- Position of the tree
- Address of the street
- Name of the specie
- Diameter
- Height
- Dieback percentage
- Explain how the users can contribute in retrieving data

Machine Phenomena

- Visualization of the data by map-based views
- Statistical processing on the data
- Update the visualization of data whenever the epicollect form is updated

Use Cases

In the following part we're going to discuss different general scenarios of the use of the system. Each scenario describes a sequence of events.

Scenario:	User's registration
Participating actors:	Every user
Entry conditions:	User is not yet registered
Flow of events:	<ul style="list-style-type: none">- User goes to the registration page- System opens the registration page and establish a connection with the database- User inserts data- User commit the operation
Exit conditions:	The system returns the result of execution of the operation
Exceptions:	<ul style="list-style-type: none">- User insert wrong data- System fails during the execution of the process
Special Requirements:	System operation is very fast

Scenario:	User's login
Participating actors:	Every user
Entry conditions:	The user is already registered
Flow of events:	<ul style="list-style-type: none">- The user clicks the login option- The system opens the page to enter data- The user inserts data- The user clicks the confirm option- The system informs the user about the end of the operation
Exit conditions:	The system confirm that the user is entered in his private area of the system
Exceptions:	The system failed or the user inserts wrong data

Scenario:	User's logout
Participating actors:	Every user
Entry conditions:	The user is already registered
Flow of events:	<ul style="list-style-type: none">- The user clicks the logout option- The system informs the user about the end of the operation
Exit conditions:	The system confirms that the user is out from the private area
Exceptions:	The system failed

Scenario:	User leaves a comment
Participating actors:	Every User
Entry conditions:	User is registered
Flow of events:	<ul style="list-style-type: none"> - User logs in - User visualize the data and select a specific point - System show the point's attributes and comments - User select the 'add comment' option - User write the comment - User submit the comment - System upload the comment
Exit conditions:	System returns the result of the uploading operation
Exceptions:	<ul style="list-style-type: none"> - User is not logged in - The comment inserted is empty - System fails during the uploading of the comment
Special Requirements:	Comment must be consistent and polite otherwise they could be deleted from the system's developers

Scenario:	User modify a comment
Participating actors:	Every User
Entry conditions:	User is registered User has already written a comment
Flow of events:	<ul style="list-style-type: none"> - User logs in - User visualize the data and select a specific point - System show the point's attributes and comments - User select the 'add comment' option - User write the comment - User submit the comment - System upload the comment
Exit conditions:	System returns the result of the uploading operation
Exceptions:	<ul style="list-style-type: none"> - User is not logged in - The comment inserted is empty - System fails during the uploading of the comment
Special Requirements:	Comment must be consistent and polite otherwise they could be deleted from the system's developers

Scenario:	User deletes a comment
Participating actors:	Every User
Entry conditions:	User is registered User has already written a comment
Flow of events:	<ul style="list-style-type: none"> - The user clicks the delete option - The user clicks the confirm option - The system informs the user about the end of the operation
Exit conditions:	The system confirms that the delete of the new comment has been successful
Exceptions:	<ul style="list-style-type: none"> - User is not logged in - The comment does not exist - System fails

It will be possible for the user to upload new data through the Web Application, data will be stored in a Data Base and it will be possible to visualize them on a map.

Scenario:	Data insertion
Participating actors:	Every User
Entry conditions:	User is registered
Flow of events:	<ul style="list-style-type: none"> - User logs in - User clicks on the “add data” operation - System connect to the page in which is possible to insert new features - User clicks the confirm option - System uploads data
Exit conditions:	The system confirms that the upload has been successful
Exceptions:	<ul style="list-style-type: none"> - User is not logged in - the user does not fill in all the features - System fails during the uploading

The user will be also able to manage data with the tools present in the system. In the following tab we’re describing possible scenario of use of statistical tools:

Scenario:	Observe the distribution of a data field
Participating actors:	Every User
Entry conditions:	User is registered and logged in
Flow of events:	<ul style="list-style-type: none"> - User logs in

	<ul style="list-style-type: none"> - User access the page of data processing - User visualizes static graphs about distribution - User clicks on a “pie chart” to visualize a pie chart about species - User clicks on “dynamic histogram” to visualize a histogram describing data distribution for every road
Exit conditions:	The graphs are visible on the page
Exceptions:	<ul style="list-style-type: none"> - User is not logged in - System fails - The output of the computation is not printed on the page
Special Requirements:	User knows the basics of statistic in order to understands the usage of the tools and the meaning of the results obtained

Domain Assumptions and Requirements

The further step to do is define more precisely the domain assumptions and the requirements.

Domain assumptions are used to indicate the descriptive assertions assumed to hold in the world, the machine is not involved. In our case the domain entities are the users and the trees, and the assumptions we must do are the following ones:

- The user must be registered on the app.
- The user should have a minimum knowledge of statistics in such a way that he can correctly understand the data visualization, graphics and manipulation.
- No trees were removed in the time lapse between data collection and user research.
- The user should be able to read maps.
- The user should have a basic knowledge about trees, their main characteristics and differences between species.

Requirements are prescriptive assertions formulated in terms of shared phenomena.

As previously defined in chapter 3, shared phenomena are a link between the machine and the world and they can be controlled by the world and observed by the machine (attributes the user asks the machine regarding the trees) and controlled by the machine and observed by the world (allocation of the right information to give to the user).

The requirement of this app is therefore to provide the right information according to the user's request, the software must be able to process the data and create graphs and maps that can be easily interpreted by the user.

More precisely, users will be able to register, login and logout; they will be also able to leave comments and modify or delay it.

The application must make it available to the user an interactive explorative map through which to read height, diameter, name of the species and dieback percentage of the trees in Winamac. Interactive exploratory graphs will also be present through which to see the distribution of the diameter and the height. There will be also a dynamic histogram that plots, for each street, the mean value of diameter, height and dieback percentage and a pie chart of the species. Users will be able also to contribute in collecting data, thus increasing the database. They may add information on new trees in Wimanac not yet registered on the site, by entering height, diameter, species, dieback percentage, latitude and longitude of each tree. These new trees will also be visible in the interactive map with a different color from those of Epicollect5, in order to distinguish them.

Effort

Despite the disadvantages we are facing in this particular period of health emergency, we decided to work as a team and, after a first virtual meeting, during which we shared our ideas and we discussed about which Epicollect5 project to choose, we decided to focus on a project whose principal argument was close to our personal course of study: the environment.

After having defined the guidelines of our project we decide to split the work as it follows: Gabriele focused in defining the project scope and goals and the domain analysis, Marianna worked on identifying the relevant phenomena, Martina hypothesized different possible use cases and Chiara deducted all the domain assumptions and the requirements.

The individual work took about three hours for each one of us, including the time spent for personal researches and for revising theory of Requirement Engineering.

The group commits to deliver the complete Web Application and the requested documents within the fixed dates.