Tree Plantation Estimation - SRS

Estimating no. of trees required in a city to maintain air quality index

NOVEMBER 2022

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1. Introduction

1.1 Purpose

Because of its adverse effect on human health, air pollution is an environmental problem of major concern. Due to the high traffic density, cities often face increased concentrations of air pollutants in comparison with their surroundings. In order to mitigate these air pollutant problems, plantation of trees is often promoted as an effective measure to reduce concentrations.

This measure is based on the underlying argument that trees (and vegetation in general) have the capability of cleaning the air by filtering out the pollutants. Vegetation leaves absorb gaseous pollutants through their stomata, while particles are removed from the air by deposition onto the leaves and the branches.

Poor air quality has become a major cause of premature death and illness and is the largest environmental health risk(WHO, 2016, 2014). Poor air quality is responsible for approximately 1 in 9 deaths worldwide (WHO, 2016).

1.2 Project Scope

This system is aimed to be totally efficient and the easiest user interface for showing the number of trees to be grown in a particular city/area on the basis of the air quality index of the city. The result would be shown on the basis of the analysis of the AQI over a period of time.

This system will create an awareness among the peoples of all age groups about the increasing level of pollution and role of tree plantation in reducing the pollution.

This system is highly secure as it does not require the personal information of the user. By using this system we can know the amount of usable land left in the city/area.

1.3 Definitions
1. AQI -Air Quality Index
2. GUI - Graphical User Interface
3. WHO - World Health Organization
4. OS - Operating System

1.4 References
- https://www.sciencedirect.com/science/article/pii/S2210670720305771
- https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1532968131.pdf

2. Overall Description

2.1 Product's Vision:

The vision behind this product is to plant more and more trees to reduce the level of global warming and to improve the air quality index of the particular city. Basically it uses data like the Air quality index of a place, amount of land left for plantation of trees.

By using this product we can bring awareness to people for planting more and more trees and to show how plantation brings benefits to nature. The plus point of this product is that no personal information about the user is required to be entered as nowadays we know what is the value of this data.

So basically this is one of the products to save nature and to spread awareness among the people especially in children from a very tender age.

2.2 Product's Functioning:

This is a prediction based model where the name of the city is entered and according to AQI the number of trees to be planted is shown so that AQI can be improved with time. Data to be entered:
- City Name (Name of the Indian City about which you require the information)

Product should support the following functions:

Class of Use Case	Use Cases	Description of Use Case
Use case related to opening of website	Loading website	User opens the site
Use Case related to system authorization	Login Change Password Register	Login to website Change password Create new account
Use case related to data entry	Enter City	Prediction is performed and the output is displayed
Use case related to "News and Headlines"	View information Comment and Like	Displays recent articles on environmental topics User can comment or like news articles
Use case related to "About Us"	View information about website	Displays team, and information about the project site
Use case related to "My Details"	View account information Change username	Displays user details Changes user's username

2.3 Basic Requirements:

The user must have basic knowledge about AQI.
Users must have basic items to search and analyse the data like valid internet connection and device with internet connection.

2.4 User Characteristics

Users are expected to be acquainted with web-based technologies

3. Functional Requirements

3.1 Interfaces

Users will interact with this system using GUI. With consideration to the RPD (Rights of Persons with Disabilities) Act 2016, GUI components and interfaces will have Alt-Text functionality, so that every person is equally capable of handling the software.

3.1.1 Hardware Interfaces

The software will run using the internet, so connectors will be hardware interfaces for this software. Such as, WAN-LAN, Ethernet, etc.

3.1.2 User Interfaces

The user interface should be compatible with OS like Windows, Android, iOS and will be made mobile and PC compatible.

3.2 Use Case Description

**Use case related to opening of website:**

**Use Case 1: User loads the website**

Primary Actor: User

Pre-Condition: Internet connection available.

Main Scenario:

    1. User initiates installation.

Alternate Scenario:

    1. Network failure.

**Use cases related to system authorization:**

**Use Case 2: Login**

Primary Actor: User

Pre-Condition: Nil

Main Scenario:

    1. Start the website.

    2. User prompted for login and password.

3. User gives the login and password.

4. System does authentication.

Alternate Scenario:

1. Authorization fails

2. Wrong password or username was entered, prompt is generated.

3. User re-enters details

Use Case 3: Change Password

Primary Actor: User

Pre-Condition: User logged in

Main Scenario:

1. User initiates the password change command.

2. Users enter an old password, a new password and confirm the new password.

3. System does authentication.

4. New password is registered with the system.

Alternate Scenario:

1. Authorization fails

2. Prompt the user that he typed the wrong password

3. Allow them to re-enter the password.

4. New password and confirm new password do not match.

Use Case 4: Register

Primary Actor: User

Pre-Condition: Nil

Main Scenario:

1. User enters name, email, password.

2. System does authentication.

3. Account is created

Alternate Scenario:

1. Authorization fails

2. Email id is invalid or already registered

3. Allow them to re-enter email-id.

Use Case related to Data entry

Use case 5: Enter city name

Primary Actor: Can be user or guest

Pre-Condition: Nil

Main Scenario:

1. User enters name of a city
2. Suggestions for possible city name is seen in input box
3. Resultant data is displayed on screen (Estimation of no. of trees required)

Alternate Scenario:

1. Data for entered city is unavailable
2. Prompt the user to enter another city name

Use Case related to News Section

Use case 6: Display News and Headlines

Primary Actor: User

Pre-Condition: User logged in

Main Scenario:

1. Users can view various headlines and latest articles related to environment and pollution.
2. An article can be read in more detail by clicking on it

Use case 7: Comment and Like

Primary Actor: User

Pre-Condition: User logged in

Main Scenario:

1. User can post comment
2. User can like a news article

Alternate Scenario:

1. Comment exceeds word limit
2. Prompt user to shorten the comment

Use Case related to About Us

Use case 8: Display About Us page

Primary Actor: Can be user or guest

Pre-Condition: Nil

Main Scenario:

     1. Information about the website and it's developers is displayed

Use Case related to My Details

Use case 9: Display My Details page

Primary Actor: User

Pre-Condition: User logged in

Main Scenario:

     1. Users can view their personal information (email, name, username, etc)

Use case 10: Change username

Primary Actor: User

Pre-Condition: User logged in

Main Scenario:

     1. User can change username by entering a new one in exchange

Alternate Scenario:

     1. Username already exists

     2. Prompt user to enter another username

     3. Allow them to re-enter username

4. Non-Functional Requirements

4.1 Response Time

The response time of the webpage should not be more than 5 secs.

4.2 Usability

The user interface should be as simple as possible so that it is easily understandable for any age group of people.

4.3 Modifiable

The system should be easily modifiable and updateable.

4.4 Accuracy

The system should be highly accurate so that wrong predictions can be avoided and the system should evaluate the data with the highest precision with the training dataset so that the result is displayed accurately.

4.5 Performance Requirement

System should run on a 500MHz, 64 MB machine.

4.6 Software Quality Attributes

(a) Availability

In case of system failure, the system shall allow users to restart the application.

(b) Security

1. The system shall not leave any cookies on the user's device containing confidential information like password.
2. The system's back-end servers will be encrypted.

5. Future Enhancements

→ We can advance the prediction by predicting what trees should be planted along with their number based on their impact on the environment.

→ We can look into patterns and area distribution of the city and then predict plantations based on it.

→ Use visualisation on maps to predict the exact area where more plantation is required and along with it land records must be public so that there is no legal trouble while planting.

→ Make software more visually appealing along with more features that predict the plantation of trees more effectively.

→ Using more advanced predictions where we can save the soil from soil erosion by planting trees on the border of land which can serve both purposes. This also prevents soil erosion on barren lands.

→ Using satellite maps to predict whether the trees are present in those areas or not. More are required and not to predict areas where plantation is already there.

Tree Plantation Estimation

Risk, Quality Assurance, Gantt

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Quality Assurance

According to the ISO Standards of Software Quality management:

Functionality

This is a prediction based model where the name of the city is entered and according to AQI the number of trees to be planted is shown so that AQI can be improved with time.
This function of the software has been implemed and mapped according to the srs.
To test the functionality of software we have developed test cases which will be listed in test case document

Accuracy

As far as accuracy is concerned the model used was 97 percentage accurate on training data.

Interoperability

The data was imputed via form from the javascript and was sent to python with the use of flask hence we can say that our system is interoperable as the output was as expected.

Compliance

Product was tested by Pranita and Jatin for compliance according to them the coding standards has been followed

Security

As far as our product is concerned there was no need of security , the data is directly transferred and results are shown at an instance and data is not been shared or stored

Reliability

Software was tested continuously for a certain period of time and test was successful

Fault tolerance: The Fault is a state that causes the software to fail to accomplish its essential function.

Fault	Fault Tolerance
In building the dataset of the model	We collated the data of cities , there air quality index and how does air quality index is affected by number of trees grown There was lot of inconsistency in the data , this was solved by data cleansing
In integrating javascript with the python	

Usability

Usability testing is defined as the evaluation of a product by testing it on potential users. Hallway usability testing was done by randomly selecting our classmates and they used the websites on their phone and on laptops which was successful,hence we can say that our product is easy to use.

Efficiency

The degree to which the software makes optimal use of system resources as indicated by the following sub attributes: time behaviour, resource behaviour.

Maintainability

The ease with which repair may be made to the software as indicated by the following sub attributes: analyzability, changeability, stability, testability.

SQA PLAN

➔ Roles and Responsibilities of SQA Team

No	Member	Roles	Responsibility
1	Member 1	SQA Leader	Develop and document quality standard and process for all management process Manage software quality assurance activities for the project
2	Member 2	SQA auditor	Perform SQA tasks, report to SQA leader the result of SQA review.
3	Member 2	SQA auditor	Perform SQA tasks, report to SQA leader the result of SQA review.

➔ Work Products to be Reviewed

No	Management Phases	Work product	Permission	Grant to Person
1	Risk analysis	Risk Management document	Read	All SQA Team Members
2	Estimation	Estimation and Metrics report	Read	Member 1
3	Planning	Test Planning document	Read	All SQA Team Members
4	Organisation	Human resource plan, training plan	Read	All SQA Team Members

5	Monitoring and Control	Collected metrics of project effort	Read	Member 2
6	Issue Management	Issue management report	Read	Member 1
7	Test report	Test Report document	Read	All SQA Team Members

➔ **Schedule**

Date	SQA Tasks	Personal in charge	Description	Output
10-Oct-2022	Evaluate project planning, tracking and oversight processes	Member 1	– Software Specification Review – Estimation, Master Schedule and Project Plan Review	SQA planning report, SQA review minute
19-Oct-2022	Review requirement analysis	Member 1	– Review the software requirement development	Process audit report
26-Oct-2022	Review and Evaluate Test Design	Member 1	– Review the Test Design document	SQA report, SQA review minute
27-Oct-2022	Review release	Member 2	– Process Audit: Final Release	SQA process audit report
28-Oct-2022	Review Project closing	Member 2	– External review after final delivery to customer	SQA process audit report

Risk Management

Fortunately, the awareness of people to get a better life has developed a way to maintain the sustainability of nature by introducing a concept called urban forest. Urban forest is a network or system comprising all woodlands, groups of trees, and individual trees which are located in urban and peri-urban areas. It can be forests, street trees, and trees in the parks and gardens. Through the urban forest concept, it is possible to get more space for living space without damaging the sustainability of nature. But a new challenge comes from the hazard of fallen trees to the surroundings, including human activities. So, it is important to discuss the risk identification, assessment, and mitigation of trees in urban forest.

1. Structure of vegetation of the area

2. Identification and assessment

Tree risk assessment is a system to identify, analyse, and evaluate the risk of trees. This process started by identifying the current situation and location of trees. It included identifying the tree species and their characteristics. After all of that information obtained, tree hazards were analysed according to information gained. And then possible risks caused by trees were evaluated. Tree risk assessments are categorised based on time, training, and equipment requirements

3. Mitigation activities

Mitigation activities are necessary to reduce the risk from trees to the surroundings, including towards human activities. But to create good mitigation planning, several aspects must be taken into consideration such as: policy and legal framework; planning, design and management; key monitoring criteria; key competencies/skills to be developed; the major knowledge gap that must be overcome; and helpful factual advocacy. Human capital developments are needed to ensure all staffs who are in charge of trees management possess competent skills and requirements.

Testing

➔ **Test Approach**
- *Process of Testing*
    - ➔ The content model for the WebApp is reviewed to uncover errors.
    - ➔ The interface model is reviewed to ensure that all use cases can be accommodated.
    - ➔ The design model for the WebApp is reviewed to uncover navigation errors.
    - ➔ The user interface is tested to uncover errors in presentation and/or navigation mechanics.
    - ➔ Each functional component should be unit tested.
    - ➔ Navigation throughout the architecture is tested.
    - ➔ The WebApp is implemented in a variety of different environmental configurations and is tested for compatibility with each configuration.
    - ➔ Security tests are conducted in an attempt to exploit vulnerabilities in the WebApp or within its environment.
    - ➔ Performance tests are conducted.
    - ➔ The WebApp is tested by a controlled and monitored population of end users. The results of their interaction with the system are evaluated for content and navigation errors, usability concerns, compatibility concerns, and WebApp reliability and performance.

- *Types of Testing*
    1. Unit Testing
        - Test the smallest piece of verifiable software in the application

    2. API Testing
        - Test the API's created for the application

    3. Integration Testing

- Individual software modules are combined and tested as a group

4. System Testing
- Conducted on a complete integrated system to evaluate the system's compliance with its specified requirements

➔ **Unit Testing - Test Cases**

				Testing Modules					
Project Name:	Tree Plantation Estimation								
Written & Executed By:	Group 15								
Test Case ID	**Test Case Scenario**	**Test Case**	**Pre-Condition**	**Test Steps**	**Test Data**	**Expected Result**	**Post Condition**	**Actual Result**	**Status (Pass/Fail)**
TPE_001	Access information	Search city name	Nil	Enter city name and search	City name	Estimated trees and AQI is displayed	Return to dashboard	Estimated trees and AQI is displayed	Pass
TPE_002	Login	User logs in	User is already registered	Enter email/username and password	Email or Username, Password	Prompt saying "Login successful"	User is logged in	Prompt is displayed	Pass
	Change Password	User changes password	User is logged in	Choose the option to change password, enter new password	New password	Password is updated in database	New password is set	Password is updated	Pass
	Registration	New user registers	Nil	Enter details and submit	Name, email, password	User info is stored in database	User is logged in	Registration is finished	Pass
	Registration	New user registers - email already exists	User submits information while registering	Email id entered by new user already exists	Email id	Prompt asking user to enter another email id	User enters new email	Prompt is displayed	Pass

Stakeholder Analysis

List of Stakeholders

→ Developers

→ Managers

→ Investors

→ Environmental Activist

→ Tree Planters

Stakeholder Interest and Impact Table

| Stakeholder	Interests	Estimated Project Impact	Estimated Priority
Developers	- Developing the software - Actual interest in the topic	High	1

Project Managers	- Managing the project - Detailed study of the topic and instructing the developers regarding the same	Med	2
Investors	- Returns after the completion of the project	Low	5
Environmental Activities	- Whether the tree plantation will actually bring change	Med	3
Tree Planters	- Actual implementation of this project	Med	4

Change Management

Request	Impact	Date Started	Date Ended
Take more factors into consideration for predicting AQI and trees to be planted	More accurate and relevant outputs	-	-
Incorporating records of more cities in the database	Predictions can be made for more cities	-	-

Gantt Chart
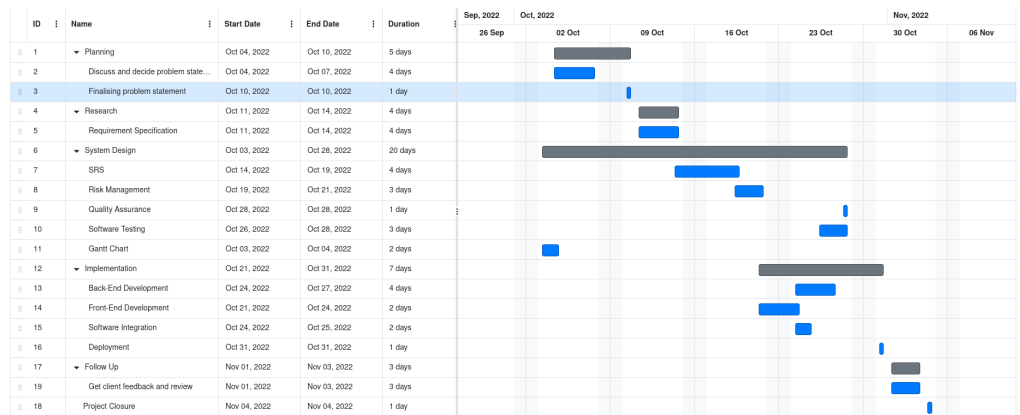
ID	Name	Start Date	End Date	Duration
1	▼ Planning	Oct 04, 2022	Oct 10, 2022	5 days
2	Discuss and decide problem state…	Oct 04, 2022	Oct 07, 2022	4 days
3	Finalising problem statement	Oct 10, 2022	Oct 10, 2022	1 day
4	▼ Research	Oct 11, 2022	Oct 14, 2022	4 days
5	Requirement Specification	Oct 11, 2022	Oct 14, 2022	4 days
6	▼ System Design	Oct 03, 2022	Oct 28, 2022	20 days
7	SRS	Oct 14, 2022	Oct 19, 2022	4 days
8	Risk Management	Oct 19, 2022	Oct 21, 2022	3 days
9	Quality Assurance	Oct 28, 2022	Oct 28, 2022	1 day
10	Software Testing	Oct 26, 2022	Oct 28, 2022	3 days
11	Gantt Chart	Oct 03, 2022	Oct 04, 2022	2 days
12	▼ Implementation	Oct 21, 2022	Oct 31, 2022	7 days
13	Back-End Development	Oct 24, 2022	Oct 27, 2022	4 days
14	Front-End Development	Oct 21, 2022	Oct 24, 2022	2 days
15	Software Integration	Oct 24, 2022	Oct 25, 2022	2 days
16	Deployment	Oct 31, 2022	Oct 31, 2022	1 day
17	▼ Follow Up	Nov 01, 2022	Nov 03, 2022	3 days
19	Get client feedback and review	Nov 01, 2022	Nov 03, 2022	3 days
18	Project Closure	Nov 04, 2022	Nov 04, 2022	1 day