EnvironHub: A Portal for Environmental Pollution Awareness and Peer-Verified Research

(Minor Project)

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I, Mr.Angad Gill, Roll No.04617002023,Certify that the Project Report/Dissertation entitled Environment Pollution is done by me and it is an authentic work carried out by me at TecniaInstitute of Advanaced Studies. The matter embodied in this project work has not been submitted earlier for the award of any degree or diploma to the best of my knowledge and belief.

Signature of the student   Signature of the Guide

CERTIFICATE FROM THE GUIDE

This is to certify that the project entitled “EnvironHub: A Portal for Environmental Pollution Awareness and Peer-Verified Research” submitted by Mr. Angad Gill (04617002023) in partial fulfillment of the requirements for the degree of Bachelor of Computer Applications to Tecnia Institute Of Advanced Studies, is an authentic work carried out by him under my guidance and supervision. The matter embodied in this project work has not been submitted earlier for the award of any degree or diploma to the best of my knowledge and belief.

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ACKNOWLEDGEMENT

This is to certify that the dissertation/project report entitled “Environment Pollution” is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Computer Applications under the guidance of Dr. Nipur Jain(Assistant Professor). The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

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LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Description
1	UI	User Interface
2	API	Application Programming Interface
3	CSS	Cascading Style Sheets
4	HTML	HyperText Markup Language
5	JS	JavaScript
6	HTTP	Hypertext Transfer Protocol
7	JSON	JavaScript Object Notation
8	IDE	Integrated Development Environment
9	DFD	Data Flow Diagram
10	SDLC	Software Development Life Cycle

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ABSTRACT

Environmental pollution continues to pose a severe threat to public health, ecosystems, and sustainable development, particularly in rapidly developing countries like India. Despite the availability of research and government reports, information related to air, water, and soil pollution remains scattered, difficult to verify, and inaccessible to the general public. This gap contributes to misinformation, reduced public engagement, and limited collaboration among researchers, students, and policymakers. To address these challenges, this project proposes *EnviroHub*—an interactive, web-based Environmental Pollution Awareness and Research Platform developed using the MERN stack (MongoDB, Express.js, React.js, Node.js).

The system integrates educational content with user-generated research contributions, supported by a secure JWT-based authentication mechanism. Users can upload research papers, which undergo an admin-controlled verification process to ensure credibility. Verified documents are marked with a visual blue-tick indicator, while unverified submissions are removed to maintain information accuracy. Additional features such as role-based dashboards, a commenting system, and community discussions enable collaborative knowledge exchange and enhance user engagement.

The platform's methodology includes requirement analysis, UI/UX design, modular development, testing, and cloud deployment. It offers a scalable technical framework with future expansion possibilities including AI-based plagiarism detection, multilingual support, real-time pollution data integration, and mobile application development. Overall, the project contributes academically by demonstrating a practical application of full-stack web development and socially by promoting awareness, reducing misinformation, and fostering collaborative environmental research.

CHAPTER 1

SYNOPSIS

1.1. Introduction

Environmental pollution has emerged as one of the most pressing challenges of the 21st century, affecting ecosystems, human health, and global sustainability. Rapid industrialization, urbanization, and unregulated human activities have contributed to alarming levels of air, water, and soil pollution worldwide. According to the World Health Organization (WHO), air pollution alone causes an estimated 7 million premature deaths every year, while water pollution leaves nearly 2 billion people without access to safe drinking water. Soil contamination, on the other hand, threatens agricultural productivity, food security, and biodiversity.

India, due to its dense population and fast-paced development, faces severe pollution-related crises. Reports indicate that 21 out of the world's 30 most polluted cities are in India, and polluted rivers like the Ganga and Yamuna continue to endanger both human lives and aquatic ecosystems. These alarming statistics highlight the urgent need for awareness, preventive measures, and sustainable solutions.

Conventional awareness campaigns, however, often lack interactivity, credibility, and reach. In many cases, research findings remain scattered, unverified, or inaccessible to the general public. This results in misinformation, lack of collaboration, and missed opportunities to implement effective pollution control strategies.

With the rise of digital technologies, web-based platforms can now play a vital role in spreading awareness, verifying research, and enabling collaboration among researchers, students, and policymakers. This project, Environmental Pollution Awareness and Research Hub, aims to create a centralized and interactive web application using the MERN stack (MongoDB, Express.js, React, and Node.js). The system allows users to:

- Learn about the definition, types, causes, effects, and control measures of air, water, and soil pollution.
- Create accounts and log in securely using JWT-based authentication.
- Upload their own research papers or findings related to pollution.
- Have submissions verified by admins (with a dedicated admin dashboard) before being publicly visible, ensuring authenticity.
- Recognize verified documents through a visual indicator (blue tick), while unverified papers are deleted automatically to maintain credibility.
- Engage in meaningful discussions by commenting on research papers, fostering collaboration and knowledge exchange.

Thus, this project not only demonstrates the practical application of full-stack web development but also addresses a socially impactful issue by bridging the gap between environmental awareness, research, and technology. It empowers individuals and communities to share knowledge, fight misinformation, and work collectively towards a cleaner and more sustainable future.

1.2. Statement about the Problem

Environmental pollution, in the form of contaminated air, water, and soil, poses a severe threat to human health, biodiversity, and global sustainability. Rising levels of industrial emissions, untreated sewage discharge, plastic waste, and chemical contamination disrupt natural ecosystems and endanger millions of lives every year. For example, air pollution alone is responsible for millions of premature deaths, while polluted rivers and groundwater sources expose entire populations to waterborne diseases and long-term health risks. Soil degradation caused by toxic chemicals and improper waste disposal further threatens agricultural productivity and food security.

Despite the seriousness of the problem, one of the biggest challenges lies in the lack of centralized and reliable systems for awareness, research sharing, and collaboration. At present, most information about pollution is scattered across different platforms—ranging from government reports and academic journals to unverified social media posts. This fragmentation results in misinformation, limited public engagement, and reduced accessibility for students, researchers, and policymakers. Valuable research papers often remain unpublished or unrecognized, while the general public struggles to distinguish verified information from unreliable sources.

Moreover, there is no widely accessible platform that allows individuals to publish, verify, and collaborate on pollution-related findings in real-time. Without proper verification, misinformation spreads easily,

undermining efforts to combat pollution. At the same time, researchers and environmentalists lack an interactive space to exchange ideas, validate findings, and engage with the wider community.

This absence of a unified digital platform creates a major gap in environmental awareness and knowledge dissemination. Unless addressed, it will continue to hinder efforts to reduce pollution and achieve sustainability goals. Hence, there is an urgent need for a technologically driven solution that not only provides authentic educational content on pollution but also enables users to share research papers, ensures verification by administrators, and fosters meaningful discussions. Such a system would significantly improve public awareness, minimize misinformation, and encourage collective action against environmental pollution.

1.3. Why is the Particular Topic Chosen?

Environmental pollution has always been one of the most critical global issues, especially in developing nations like India where rapid urbanization, industrialization, and population growth have significantly worsened the problem. Every year, millions of people suffer from health issues such as respiratory diseases, waterborne infections, and soil-related food contamination due to unchecked pollution. Reports consistently rank Indian cities among the most polluted in the world, while rivers and agricultural lands continue to degrade at alarming rates. Traditional awareness campaigns, fragmented research publications, and limited access to credible information have proven insufficient to address the scale of this crisis.

This project has been chosen because it seeks to address these real-world challenges through the use of modern web technologies. By adopting the MERN stack (MongoDB, Express.js, React.js, Node.js), the system provides a robust, scalable, and user-friendly platform that not only spreads awareness but also facilitates research sharing and collaboration. Users can log in securely, upload their research papers or findings, and actively engage in knowledge exchange through comments and discussions.

Unlike conventional methods, this platform introduces a structured verification mechanism where uploaded research papers are reviewed by administrators before being displayed. Verified papers are marked with a visual indicator (such as a blue tick), ensuring authenticity and trustworthiness. This feature directly tackles the widespread issue of misinformation while promoting transparency and accountability in knowledge dissemination.

By combining educational content, user contributions, and administrative verification, the platform bridges the gap between public awareness and credible research. It empowers students, researchers, policymakers, and the general public to collaborate on solutions for reducing air, water, and soil pollution. Thus, the choice of this topic reflects not only its academic relevance but also its social importance and long-term impact in the fight for a cleaner and healthier environmen.

1.4. Objective and Scope of the Project

1.4.1 Objectives

The primary objective of this project is to develop a centralized, web-based platform that spreads awareness about environmental pollution while enabling the sharing and verification of research findings. The specific objectives are as follows:

- To Awareness and Education – To provide structured and reliable information on the definition, types, causes, effects, and control measures of air, water, and soil pollution in a user-friendly format.
- To User Authentication and Access – To implement secure login and registration using JWT-based authentication (access and refresh tokens) so that users can create accounts, manage their profiles, and participate actively.

- To Research Paper Upload System – To allow registered users to upload their own research papers or findings related to pollution, thus contributing to a growing digital knowledge base.
- Verification Mechanism – To establish an admin-managed verification process where uploaded research papers are reviewed, approved, and marked with a visible blue tick, while unverified papers are removed to ensure credibility.
- Admin and Moderator Dashboards – To provide administrators and designated moderators with role-based dashboards for managing research papers, user activities, and verification workflows.
- Community Engagement through Comments – To enable users to comment on research papers, fostering meaningful discussions, feedback, and collaboration among researchers, students, and environmental enthusiasts.
- Credibility and Transparency – To build trust by ensuring only verified information remains accessible, thereby reducing misinformation and promoting accountability.

1.4.2 Scope of the Project

EndUsers:

The system will benefit multiple stakeholders, including:

- General Public – who can learn about the causes, effects, and control measures of air, water, and soil pollution.
- Students and Researchers – who can upload, share, and access pollution-related research papers and findings.
- Administrators and Moderators – who verify uploaded content, maintain platform credibility, and manage community interactions.

Functional Scope:

The platform will include core functionalities such as:

Secure user authentication and authorization using JWT-based access and refresh tokens.

Research paper upload system, allowing users to contribute their findings.

Verification workflow where admins and moderators review papers and assign a visual indicator (blue tick) to verified content.

Admin dashboard for managing users, research papers, and verification status.

Commenting system to encourage discussions and feedback on uploaded research papers.

Deletion of unverified content to maintain trustworthiness and prevent misinformation.

Technical Scope:

The project will be implemented using the MERN stack (MongoDB, Express.js, React.js, Node.js).

MongoDB for storing user data, research papers, comments, and verification metadata.

Express.js & Node.js for backend APIs, authentication, and verification workflows.

React.js for a responsive, interactive, and user-friendly frontend.

JWT (JSON Web Token) for secure authentication and authorization.

Cloud/File Storage for storing uploaded documents (with integration possibilities like GridFS, AWS S3, or local storage).

Future Scope:

The platform has strong potential for expansion into a comprehensive environmental research and awareness ecosystem. Possible enhancements include:

AI-based Plagiarism and Quality Checks – to automatically screen uploaded papers for originality and relevance.

Multilingual Support – to ensure accessibility for users across different regions and languages.

Email/SMS Notifications – to alert users when their papers are verified, commented on, or flagged.

Analytics and Data Visualization – dashboards showing pollution trends, verified research contributions, and engagement metrics.

Mobile Application – to extend accessibility to Android/iOS platforms for greater user adoption.

Integration with Environmental APIs – real-time pollution data (e.g., AQI, water quality) can be displayed alongside research papers for contextual understanding.

By addressing both the immediate objectives and long-term possibilities, this project not only promotes environmental awareness but also lays the foundation for a scalable and impactful digital knowledge-sharing platform.

1.5. Literature Review

Several studies and systems have been developed to address environmental pollution awareness and research dissemination. However, most of them suffer from limitations such as lack of credibility, fragmented information, and poor accessibility. The following review highlights existing approaches and their gaps:

1. Government Environmental Portals

   National and state-level pollution control boards provide reports, guidelines, and alerts. While these are reliable, they are often static, difficult to navigate, and not interactive. They also do not allow researchers to publish or engage in discussions.

2. Research Journal Databases (e.g., IEEE, Elsevier, Springer)

   Academic journals contain credible research on air, water, and soil pollution. However, access is often restricted by paywalls, and there is no direct mechanism for public engagement or simplified awareness for non-academics.

3. Environmental NGOs Websites

   NGOs like Greenpeace and WWF provide educational resources and campaign updates. However, their platforms are advocacy-driven and lack a structured, community-driven research-sharing model.

4. Social Media Platforms (Facebook, Twitter, YouTube)

   While widely used for spreading awareness, the unverified and fragmented nature of content often leads to misinformation. Research shared here lacks credibility and is difficult to validate.

5. Academic Research Studies

   Studies published in environmental science journals emphasize ICT tools for pollution monitoring (e.g., IoT-based air quality sensors, GIS mapping). However, they acknowledge challenges such as large-scale adoption, data authenticity, and public accessibility.

Gaps Identified:

- Lack of a centralized, research-driven platform for verified pollution studies.
- No mechanism for authentication or verification of uploaded documents.
- Poor accessibility for the general public (information often remains academic-heavy).
- Dependence on social media, which spreads misinformation.

How this project addresses the gap:

The proposed Environmental Pollution Awareness & Research Hub uniquely combines:

- A centralized knowledge base with both educational content and user-uploaded research.
- Verification mechanisms by admins and moderators to ensure credibility (blue tick system).
- User engagement features like comments for discussions and feedback
- Scalable MERN-based architecture for academic and public use.
- Future extensibility with AI-driven analysis, multilingual support, and mobile accessibility.

This review demonstrates that while several platforms exist, none provide an integrated, verified, and collaborative digital ecosystem for pollution awareness and research. The current project bridges this gap effectively.

1.6. Methodology of the Project

The project *"Environmental Pollution Awareness & Research Hub"* will follow a structured methodology to ensure smooth development and deployment.

1. Requirement Analysis – Study the needs of general users (awareness), researchers (upload), and admins (verification). Identify necessary features such as document upload, verification, commenting, and role-based access.

2. System Design – Prepare the system architecture and flow diagrams. Mockups and wireframes will define the layout of the awareness pages, upload forms, verification dashboard, and comment sections.

3. Development –

   - Frontend: React.js for responsive UI.
   - Backend: Node.js with Express for APIs and authentication.
   - Database: MongoDB for storing users, research papers, comments, and verification data.
   - Authentication: JWT-based login with access and refresh tokens.

4. Key Modules:

   - User Authentication: Secure signup/login for users, researchers, and admins.
   - Awareness Module: Pages describing pollution definitions, types, causes, effects, and control measures.
   - Research Upload: Users upload documents; stored securely in DB/file storage.
   - Verification Workflow: Admins and moderators review uploaded research → verified content gets a blue tick, unverified ones are removed.
   - Admin Dashboard: Manage users, research papers, and verification status.
   - Community Engagement: Commenting system under each paper for discussions.

   Testing: Unit, integration, usability, and load testing will be applied to ensure reliability and smooth functioning.

5. Deployment: The project will be hosted on cloud platforms like Vercel/Netlify for frontend and Heroku/Render for backend, with MongoDB Atlas as the database.

1.7. Hardware & Software Requirements

1.7.1) Hardware Requirements:

- Minimum: Intel i5 processor, 8 GB RAM, 256 GB SSD.
- Recommended: Intel i7 processor, 16 GB RAM, 512 GB SSD.

1.7.2)Software Requirements:

- Frontend: React.js, Axios, TailwindCSS/Material UI.
- Backend: Node.js with Express.js.
- Database: MongoDB Atlas.
- Authentication: JWT (Access + Refresh tokens).
- Storage: Local/GridFS/AWS S3 (for research papers).
- Development Tools: VS Code, GitHub.
- Design Tools: Figma/Canva for UI.
- Testing Tools: Postman, Jest, Mocha, JMeter.

1.7.3) Testing Technologies Used

1. Unit Testing: Validates each module (upload, verify, comment).
2. API Testing: With Postman for request-response validation.
3. Usability Testing: Small focus groups for ease of use and navigation.
4. Load Testing: JMeter to simulate concurrent research uploads.
5. Cross-Browser Testing: Ensures consistency across Chrome, Firefox, Edge, Safari.

1.7.4) Process Description

1. User signs up/logs in → system assigns role (User, Admin, Moderator).
2. User uploads research paper → stored in MongoDB/file storage.
3. Admin/moderator reviews → if verified → paper is published with a blue tick.
4. If not verified → paper is removed.
5. Users can comment under each verified paper for discussions.
6. Platform continues to serve pollution awareness content alongside research sharing.

1.8. Resources and Limitations

1.8.1 Resources:

- MERN Stack technologies.
- JWT for authentication.
- Cloud hosting (Vercel, Netlify, Heroku).
- Tools: VS Code, GitHub, Postman, JMeter, Figma.

1.8.2 Limitations:

- Dependence on internet access.
- Risk of fake uploads until verified.
- No multilingual/offline support in initial release.
- Limited storage capacity in early deployment (expandable with cloud).

1.9. Contribution of the Project

1. Societal Contribution

- Awareness Platform: Educates the general public on air, water, and soil pollution.

- Credibility and Trust: Ensures only verified research is published.
- Community Engagement: Allows users to discuss solutions and findings.
- Knowledge Sharing: Bridges the gap between researchers and the public.

2. Academic Contribution

- MERN Stack Application: Demonstrates practical use of full-stack web technologies.
- Authentication & Security: Implements JWT securely for role-based access.
- Research Collaboration: Provides a model for academic collaboration in environmental sciences.
- Foundation for Future Research: Opens scope for AI-based analysis, multilingual tools, and mobile applications.

CHAPTER 2

SYSTEM REQUIREMENT ANALYSIS

System Requirement Analysis focuses on understanding the current workflow, identifying problems, and clearly establishing what the new system must achieve. This chapter includes identifying processes, inputs, outputs, data elements, controls, validation rules, and deficiencies in the existing/manual system.

2.1 Identify the Processes

The EnviroHub system consists of the following major processes:

(a) User Registration & Login

- Users create accounts and authenticate themselves.
- Admin accounts can only be created by existing admins.

(b) Research Paper Upload Process

- Users upload environmental research papers (PDF/document files).
- Metadata such as title, category (Air/Water/Soil), description, and author details are submitted.

(c) Admin Verification Process

- Admin views all pending papers.
- Admin can:
    - Approve and verify
    - Reject

  - Bookmark for later review

(d) Forum Publication Process

- Verified papers are published in the Forums section.
- Users can view and read verified papers.

(e) Discussion & Replies

- Community members post comments or replies on verified research papers.
- Admins may moderate or remove inappropriate comments.

2.2 Identify Inputs and Outputs of Each Process

(1) User Registration & Login

Input:

- Name, Email, Password, Role (User/Admin)

Output:

- Successful login session / JWT token
- Redirect to user or admin dashboard

(2) Paper Upload

Input:

- PDF file
- Title
- Description

- User ID

Output:

- Status: “Submitted for Verification”
- File stored in server database

(3) Admin Verification

Input:

- Pending paper list
- Admin action (Verify, Reject, Bookmark)

Output:

- Updated status (Verified / Rejected / Bookmarked)
- Notifications to users (optional)

(4) Forum Publication

Input:

- Verified paper data
- Associated metadata

Output:

- Paper visible in forum
- Public access to read verified case studies

(5) Comments & Replies

Input:

- Comment text
- Reply text
- User ID
- Paper ID

Output:

- Display of discussion threads under each paper

2.3 Identify Data Elements (Fields)

User Data Fields

Field Name	Type	Description
_id	ObjectId	Auto-generated unique ID
name	String	User’s full name
mail	String	User email (used for login)
pass	String	Encrypted password
organization	String	Institution or affiliation

Admin Data Fields

Field Name	Type	Description
_id	ObjectId	Unique ID for admin
name	String	Admin’s name
mail	String	Admin login email
pass	String	Encrypted password
organization	String	Admin’s institution
research_paper	Array<ObjectId>	Papers handled or uploaded by admin
role	String	Always "admin"

Research Paper Fields

Field Name	Type	Description
_id	ObjectId	Unique paper ID
title	String	Title of research paper
description	String	Short summary
refrence_links	Array<String>	List of reference URLs
verified	Boolean	Whether admin has verified paper

Field Name	Type	Description
verified_by	String	Admin name who verified the paper
organization	String	Organization of uploader
upvote	Number	Total upvotes

Request Fields

Field Name	Type	Description
_id	ObjectId	Unique request ID
name	String	Name of user who submitted paper
mail	String	Email of user
userid	String	User ID (string form)
organization	String	User's institution
research_paper	Object	Contains uploaded paper metadata before verification

2.4 Identify Procedures / Rules for Converting Input to Output

1. User Registration Procedure

- Validate user data

- Encrypt password
- Save user record
- Allocate user dashboard

2. Paper Upload Procedure

- Validate file type (PDF only)
- Store file using Multer
- Save metadata
- Set status = “Pending Verification”

3. Verification Rules

- Admin must check:
    - Authenticity of content
    - Clarity of case study
    - Relevance to environmental pollution
    - File correctness
- If standards are met → Verify
- If not → Reject

4. Forum Publishing Rules

- Only verified papers move to forum
- Automatically display title, author, description

5. Comment Validation Rules

- Comment cannot be empty

- No abusive or spam content
- Forbidden terms filtered (optional)

2.5 Identify Controls, Security, and Validation Rules

Access Controls

- Users: Upload papers, view verified studies, participate in forums
- Admins: Create admin accounts, verify papers, manage content
- Unauthorized users cannot access admin panel

Input Controls & Validation

- Email validation for registration
- PDF validation for uploads
- No empty fields in forms
- Strong password enforcement

Security Needs

- Password hashing (bcrypt)
- Session or JWT-based login
- File type security checks (no malicious files)
- Only admins can approve papers

2.6 Identify Deficiencies in the Existing System

Before digitization, the process was mostly manual:

- No structured repository for research papers
- No authentication or user roles
- No standard verification workflow
- Case studies cannot be publicly viewed or discussed
- Errors in manual storage and tracking
- Lack of transparency: no one knows which paper is verified
- No analytics or system logs
- Hard to retrieve older case studies

Thus, digitalization is essential.

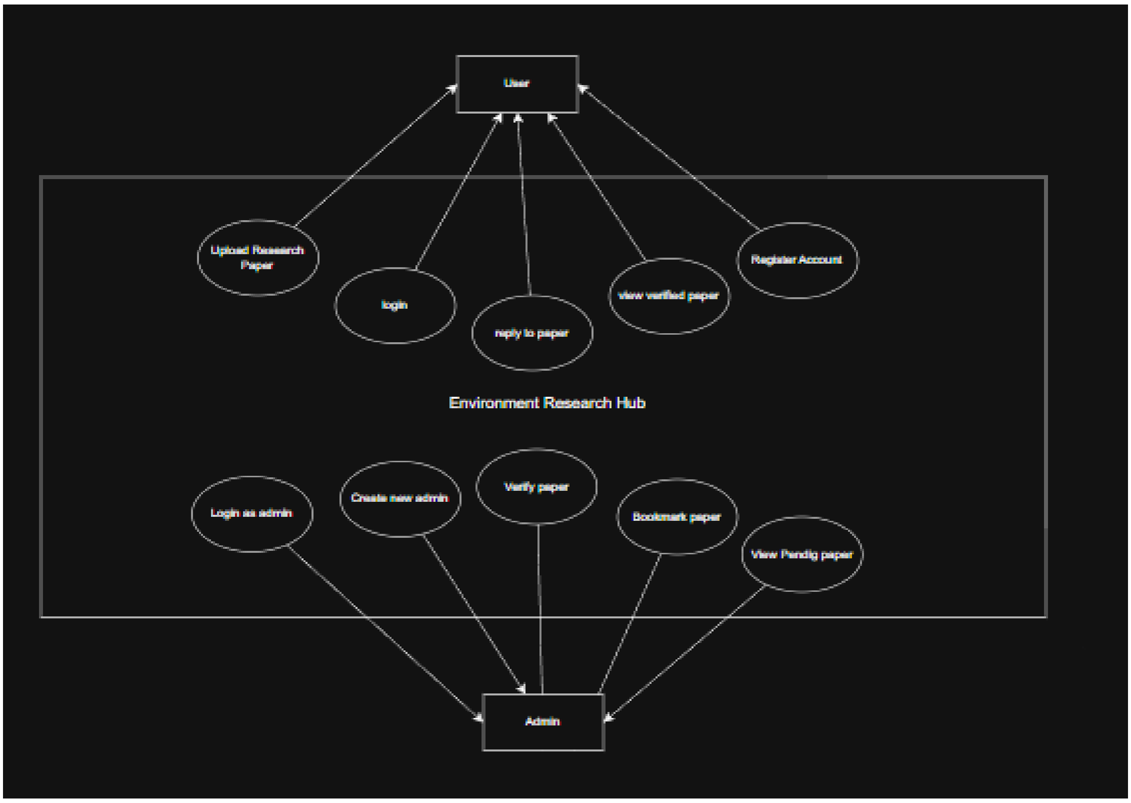
2.7 Interaction With Users and Management

Discussions with faculty guides and potential users identified the following points:

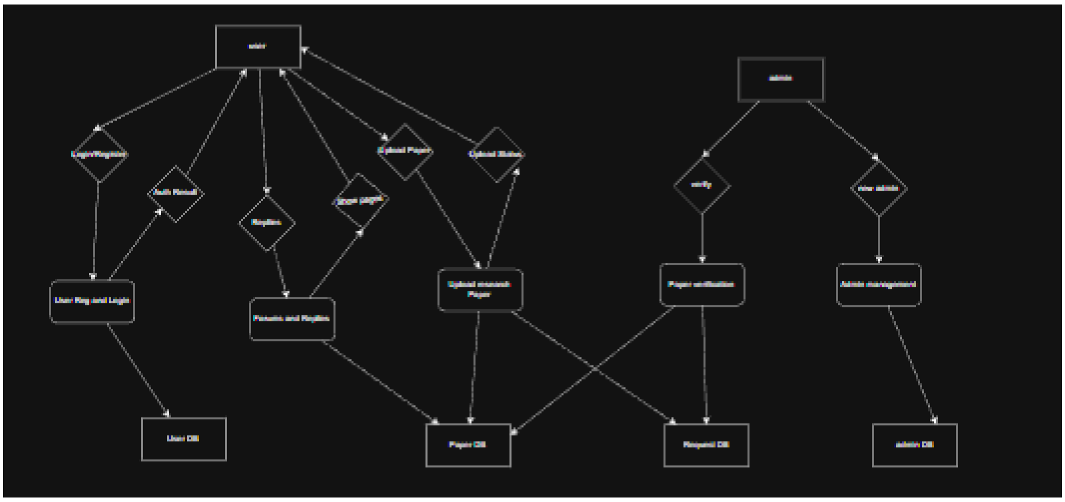
- Students want an easy way to upload case studies
- Admins want a clean dashboard to verify content quickly
- Community wants a forum-like interface to read studies
- Faculty prefers strict verification to avoid false information
- All stakeholders prefer a structured database

These interactions helped finalize the final system requirements.

2.8 Use Case Diagram



2.9 DFD Level 1 Diagram



Chapter 3

System Design

This chapter describes the complete design of the system, including its architecture, processing logic, user interface design, and database schema implemented using MongoDB and Mongoose. As the application follows a MERN-style backend, the system design emphasizes collections, schema validation, and document-based relationships instead of traditional relational tables.

3.1 Overall System Architecture

The system is developed using the following architecture:

- Frontend: React (User Interface + Forums + Upload Dashboard)
- Backend: Node.js + Express.js
- Database: MongoDB (NoSQL document storage)
- ODM: Mongoose (Schema definition, validation, relationships)
- Authentication: JWT + Cookies
- File Storage: Files stored on server (PDF/uploads) and metadata stored in MongoDB

The application follows a modular architecture with separate modules for user, admin, papers, verification workflows, and forums.

3.2 Process Identification

The system includes the following major processes:

1. User Registration & Login
2. Admin Login & Account Creation
3. Research Paper Upload by Users
4. Request Creation for Admin Verification
5. Admin Review & Verification/Bookmark/Reject
6. Display of Verified Papers in Forums
7. Upvotes, Downvotes, and Replies
8. User Profile Management

3.3 Input and Output Identification

Inputs

- User details (name, email, password, organization)
- Admin details
- Research paper (PDF file + metadata)
- Requests for verification
- Upvotes / Downvotes
- Replies on forum posts

Outputs

- Verified/Unverified paper lists
- Admin verification dashboard (pending requests)
- Forum display of accepted papers

- User profiles with uploaded papers
- System alerts (success, failure, errors)

3.4 Data Elements

Below are the main data elements used across the system:

- Name
- Email
- Password
- Paper title
- Paper description
- Reference links
- Verified status
- File object
- Upvote count
- Downvote count
- Replies array

These elements are stored as fields inside MongoDB documents using Mongoose schemas.

3.5 Processing Logic (Algorithms / Flow)

3.5.1 User Registration

1. User submits registration form

2. Backend validates fields
3. Password is hashed
4. New User document created
5. JWT token generated

3.5.2 Paper Upload

1. User selects a file (PDF)
2. Backend receives file via Multer
3. A Paper document is created
4. A Request document is created for Admin verification
5. Paper ID is linked to User

3.5.3 Admin Verification

1. Admin views pending Requests
2. Admin can accept or reject
3. If accepted → Paper.verified = true
4. Paper appears in forum listings

3.5.4 Forum Interactions

- Users can view verified papers
- Users can upvote/downvote
- Users can add replies

3.6 Interface Design

3.6.1 Output Screens

- User Dashboard (uploaded papers list)
- Admin Dashboard (pending requests)
- Forums Page (verified papers + comments)
- Research Paper Viewer

3.6.2 Input Screens

- Registration Form
- Login Form
- Upload Paper Form
- Verification Response Page

3.7 Database & Collection Design

Since the system uses MongoDB, data is stored as collections of JSON-like documents rather than relational tables.

The main collections are:

1. Users
2. Admins
3. Papers
4. Requests

MongoDB supports flexible data structures, making it suitable for storing paper files, replies arrays, and metadata objects.

3.8 Mongoose Schema Definitions (Models)

Mongoose is used to provide schema validation and references in a NoSQL database.

3.8.1 User Model (Collection: users)

Field	Type	Description
name	String	User's full name
mail	String	User’s email
pass	String	Encrypted password
organization	String	Organization name
research_paper	[ObjectId] → Paper	List of uploaded papers
role	String	Role = "user"

Purpose: Stores all registered users.

3.8.2 Admin Model (Collection: admins)

Field	Type	Description
name	String	Admin name
mail	String	Admin email
pass	String	Password
organization	String	Institute

Field	Type	Description
research_paper	[ObjectId] → Paper	Papers verified/handled
role	String	Role = "admin"

Purpose: Stores admin login credentials and linked papers.

3.8.3 Request Model (Collection: requests)

Field	Type	Description
name	String	Name of uploader
mail	String	Email of uploader
userid	String	User ID
organization	String	User’s institute
research_paper	Object	File metadata
description	String	Summary
paperid	String	ID of uploaded paper

Purpose: Stores verification requests for admin review.

3.8.4 Paper Model (Collection: papers)

Field	Type	Description
title	String	Paper title

Field	Type	Description
description	String	Paper abstract
refrence_links	[String]	Reference URLs
verified	Boolean	Verification status
verified_by	String	Admin name
organization	String	Organization
upvote	Number	Upvote count
downvote	Number	Downvote count
replies	[{name, reply}]	Forum discussions
file	Object	Uploaded file metadata

Purpose: Stores research paper data shown in forum once approved.

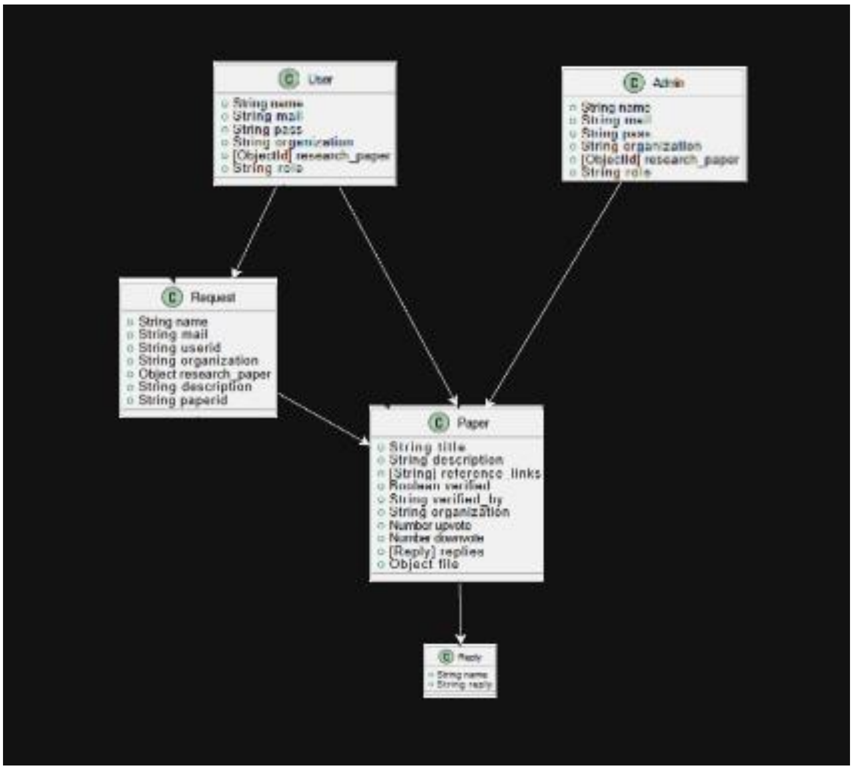
3.9 Data Dictionary

This is a simple dictionary of all data fields used across collections.

S.No	Field Name	Type	Description	Collection
1	name	String	User/Admin name	User/Admin
2	mail	String	Email ID	User/Admin
3	pass	String	Password	User/Admin

S.No	Field Name	Type	Description	Collection
4	title	String	Paper title	Paper
5	description	String	Paper summary	Paper/Request
6	file	Object	File metadata	Paper/Request
7	research_paper	Array	Paper IDs	User/Admin
8	verified	Boolean	Paper status	Paper
9	upvote	Number	Upvote count	Paper
10	replies	Array	Comments on paper	Paper

3.10 Class Diagram



3.11 Summary of System Design

In this chapter:

- The architecture of the system was defined
- All processes were analyzed
- Inputs, outputs, validations, and controls were described
- User/Admin/Paper/Request collections and schemas were designed
- All MongoDB models were documented
- Data dictionary was prepared

This system design forms the foundation for the development phase described in Chapter 4.

CHAPTER 4

IMPLEMENTATION

This chapter presents the practical realization of the system described in previous chapters. It explains how the backend, frontend, API routes, database models, authentication, user interface, and verification workflow were implemented to build a functional Environmental Research Paper Submission & Verification Platform.

4.1 Overview of the Implementation

The system was implemented using:

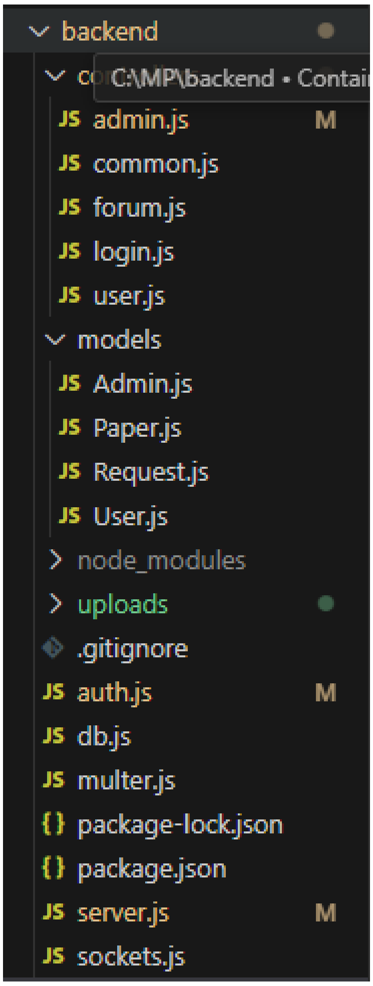
- Backend: Node.js + Express
- Database: MongoDB with Mongoose ODM
- Frontend: React.js
- Authentication: JWT & Cookies
- File Uploads: Multer
- State Management: Redux
- Architecture Pattern: REST API with MVC-like separation (Routes → Controllers → Models → DB)

The platform contains two major roles:

1. User – uploads research papers
2. Admin – verifies, bookmarks, and manages submitted papers

4.2 Backend Implementation

4.2.1 Project Structure



```
backend
  co C:\MP\backend • Contai
    admin.js        M
    common.js
    forum.js
    login.js
    user.js
  models
    Admin.js
    Paper.js
    Request.js
    User.js
  node_modules
  uploads
  .gitignore
  auth.js           M
  db.js
  multer.js
  package-lock.json
  package.json
  server.js         M
  sockets.js
```

4.2.2 Database Models (Mongoose Schemas)

Your four models appear inside /models folder.They shape how data is stored in MongoDB.

4.2.2.1 User Model

Holds user credentials, uploaded papers, and role.

```
import mongoose from "../db.js"



const userschema=new mongoose.Schema({

    name:String,
    mail:String,

    pass:String,

    organization:String,

    research_paper:[{

        type: mongoose.Schema.Types.ObjectId,

        ref: 'Paper'

    }],

    role:String

})

const User=mongoose.model('User',userschema)

export default User
```

- Fields: name, mail, pass, organization, research_paper, role
- Relationship:
    - research_paper → Array of ObjectIds referencing Paper

4.2.2.2 Admin Model

Similar to the User model but with admin-level privileges.

```
Import  mongoose from "../db.js"



const Adminschema=new mongoose.Schema({

    name:String,

    mail:String,
    pass:String,

    organization:String,

    research_paper:[{

        type: mongoose.Schema.Types.ObjectId,

        ref: 'Paper'

    }],

    role:String

})

const Admin=mongoose.model('Admin',Adminschema)

export default Admin
```

4.2.2.3 Paper Model

```
import mongoose from "../db.js";

const paperschema=new mongoose.Schema({

    title:String,

    description:String,

    refrence_links:[String],

    verified:Boolean,

    verified_by:String,

    organization:String,

    upvote:Number,
    downvote:Number,

    replies:[{name:String,reply:String}],

    file:Object

})



const Paper=mongoose.model('Paper',paperschema)

export default Paper
```

Stores research paper details:

- Title, description, reference links
- Verified status
- File object (uploaded PDF)
- Upvotes/Downvotes
- Replies for forum discussions
- Verified_by = admin name

4.2.2.4 Request Model

```
import mongoose from "../db.js";

const requestSchema=new mongoose.Schema({

    name:String,

    mail:String,

    userid:String,
    organization:String,

    research_paper:Object,

    name:String,

    description:String,

    paperid:String,

})

const Request=mongoose.model('Request',requestSchema)

export default Request
```

Stores user requests waiting for admin verification.

- Contains user info
- Research paper object
- Used as a queue for pending review

4.3 API Implementation

All route handlers are separated into controllers.

4.3.1 User Module

Features Implemented

1. User Registration
    - Stores user in MongoDB.
    - Password encrypted using bcrypt.

2. User Login
   - Validates user.
   - Generates JWT token.
   - Stores token in cookies.
3. Upload Research Paper
   - PDF uploaded using Multer.
   - Paper stored in Paper model.
   - A Request document is created for admin.
4. View Verified Papers
   - Only papers with verified = true are shown.
5. Participate in Forum
   - Users can add replies:
   - replies: [{ name, reply }]

4.3.2 Admin Module

Features Implemented

1. Admin Login
   - Similar to user login but checks role.
2. View Pending Requests
   - Admin sees all documents in Request model.
3. Verify Research Papers
   - Sets:

        - verified = true

        - verified_by = admin.name

    - Moves request to verified list.

    - Removes request from pending queue.

4. Bookmark Papers

    - Admin can bookmark papers using a separate field or list.

5. View Verified and Unverified Papers

    - Uses Paper model query filters.

4.4 File Upload Module

- Implemented using Multer

- Files stored either:

    - Locally(uploads/folder)

Paper model structure:

```
file: {
  originalname,
  mimetype,
  size,
  buffer (optional)
}
```

4.5 Authentication Module

- JWT used to generate user/admin tokens.
- Auth middleware checks whether request contains a valid token.
- Both user and admin routes are protected using:

Authorization: Bearer <token>

4.6 Frontend Implementation (React)

4.6.1 User Interface

User Screens:

- Register
- Login
- Upload Paper
- My Papers
- Forum Page (Replies under papers)

Admin Screens:

- Admin Dashboard
- Pending Requests
- Verify / Bookmark Paper
- Verified Papers List

4.6.2 Redux State Management

Redux stores:

- token
- user/admin info
- papers
- requests

4.6.3 Fetching From Backend

Example:

```
fetch("http://localhost:3001/get_forums", {
  method: "GET",
  credentials: "include",
  headers: {
      "Authorization": `Bearer ${token}`
  }
})
```

Authentication flows across all protected routes.

4.7 Forums Implementation

Forums are built inside the Paper model:

replies:[{name:String, reply:String}]

- When user adds a comment, it pushes into the replies array.
- Replies are visible to all users.

4.8 Integration Workflow

1. User uploads paper → stored in Paper collection.
2. A request document is created → stored in Request collection.
3. Admin reviews the request → approves or rejects.
4. On approval:
   - Paper.verified = true
   - Paper is available in forum
5. Users can now view and discuss paper in forums.

4.9 Summary

The system was fully implemented using:

- Node.js / Express for backend logic
- MongoDB + Mongoose for database
- React + Redux for frontend
- JWT Authentication
- Multer for File Uploads

The use of Mongoose schemas provided flexible data handling without rigid SQL tables, making the application scalable and efficient.

CHAPTER 5

TESTING AND RESULTS

5.1 Overview

Testing is a critical phase to ensure that the system performs correctly, securely, and efficiently. The objective of this chapter is to present the testing strategies used, the test cases executed, and the results obtained during the evaluation of EnviroHub.The system was tested across multiple modules such as user authentication, research paper uploads, admin verification, forums, and UI responsiveness.

5.2 Testing Methodologies Used

EnviroHub used the following testing approaches:

5.2.1 Unit Testing

Each component was tested individually:

- Login validation
- File upload module
- Admin verification functions
- Forum comments logic
- JWT verification middleware

Unit tests ensured each part of the system works independently.

5.2.2 Integration Testing

Integration tests were conducted to verify how modules work together.

Examples:

- Uploading a paper → Appearing in admin panel
- Admin verifying a paper → Appearing in forums
- Login token → Accessing user dashboard
- Comment added in forum → Displaying instantly

5.2.3 System Testing

This testing ensured the entire system works as a complete environment:

- All pages accessible
- Proper navigation between screens
- Database updates reflect correctly
- Admin and user access levels enforced

5.2.4 User Acceptance Testing (UAT)

A group of test users evaluated:

- Ease of use
- Clarity of UI
- Speed and reliability
- Accuracy of research paper listing

- Smoothness of forum interactions

Feedback was collected and improvements made.

5.3 Test Cases

Below are representative test cases executed during the testing phase:

5.3.1 Test Case 1 — User Registration

Test Case ID	TC-01
Description	Check if a new user can successfully register
Input	Name, email, password
Expected Output	“Registration Successful” message and redirect to login
Result	Passed

5.3.2 Test Case 2 — Login & Authentication

Test Case ID	TC-02
Description	Verify login with valid credentials
Input	Registered email + correct password
Expected Output	User redirected to dashboard with JWT token generated
Result	Passed

5.3.3 Test Case 3 — Upload Research Paper

Test Case ID	TC-03
Description	File upload through user panel
Input	PDF file, Title, Description
Expected Output	File uploaded + status “Pending Verification”
Result	Passed

5.3.4 Test Case 4 — Admin Verifies Paper

Test Case ID	TC-04
Description	Admin changes paper status to Verified
Action	Admin clicks “Verify”
Expected Output	Paper moves to Verified list + visible in forums
Result	Passed

5.3.5 Test Case 5 — Forums Comment Function

Test Case ID	TC-05
Description	User adds a comment on a verified paper
Input	Comment text
Expected Output	Comment appears instantly in thread

Test Case ID	TC-05
Result	Passed

5.3.6 Test Case 6 — Unauthorized Access Prevention

Test Case ID	TC-06
Description	User tries to access admin routes without admin privileges
Input	User token
Expected Output	“Access Denied” / Unauthorized
Result	Passed

5.3.7 Test Case 7 — Responsiveness Test

Test Case ID	TC-07
Description	Check UI across different devices
Devices Tested	Mobile, tablet, laptop
Expected Output	Elements aligned, menus responsive
Result	Passed

5.4 Performance Testing

Server Response Time

- All API responses were under 250ms for normal loads.

File Upload Performance

- Papers up to 20MB were uploaded successfully without timeouts.

Database Query Speed

- Queries for pending papers, verified papers, and forum threads responded efficiently.

5.5 Security Testing

Security checks included:

- JWT token expiration & validation
- Prevention of direct URL access without authentication
- Password hashing using bcrypt
- Secure upload handling using Multer
- Validation of allowed file types (only PDF)

All checks passed successfully.

5.6 Results

The testing phase confirms that EnviroHub:

- Performs all core functions reliably
- Handles user/admin workflows correctly
- Prevents unauthorized access
- Maintains data integrity
- Provides a smooth user experience

- Efficiently manages file uploads and verification

The system is stable, secure, and ready for deployment.

5.7 Summary

This chapter explained the testing techniques applied, the test cases executed, and the results obtained. All modules of EnviroHub performed as expected, and the system validated its functional, non-functional, and security requirements successfully.

INPUT:

1)Multer.js

```
import multer from "multer";
const storage=multer.diskStorage({
    destination:(req,file,cb)=>{
        cb(null,"uploads");
    },
    filename:(req,file,cb)=>{
        cb(null, Date.now()+file.originalname);
    }
})
export default storage;
```

2)Auth.js

```
import passport from "passport";
import { Strategy as LocalStrategy } from "passport-local";
import { Strategy as JwtStrategy, ExtractJwt } from "passport-jwt";
import jwt from "jsonwebtoken";
import User from "./models/User.js";
import bcrypt from "bcrypt";

export const SECRET_KEY = 'your_jwt_secret_key';

const localstrat=new LocalStrategy({
  usernameField: 'mail',
  passwordField: 'pass'
},async (mail, pass, done) => {
  const user = await User.findOne({ mail });
  if (!user) return done(null, false, { message: 'Incorrect username.' });
  const hashedpass=await bcrypt.compare(pass,user.pass);
  if (!hashedpass) return done(null, false, { message: 'Incorrect password.' });
  return done(null, user);
})


passport.use(localstrat);

const cookie_token = (req) => {
  const header_token = ExtractJwt.fromAuthHeaderAsBearerToken()(req);
  if (header_token) return header_token;
  if (req && req.cookies && req.cookies.token) {
    return req.cookies.token;
  }
  return null;
};

const opts = {
  jwtFromRequest: cookie_token,
  secretOrKey: SECRET_KEY,
};
const Jwtstart=new JwtStrategy(opts, async(jwt_payload, done) => {
  const user = await User.findById(jwt_payload.id);
  if (user) {
    return done(null, user._id);
  } else {
    return done(null, false);
  }
})
passport.use(Jwtstart);
```

```
export {passport};
```

3)DB.js

```
import mongoose from "mongoose";
mongoose.connect("mongodb://127.0.0.1:27017/Environment")
    .then(()=>{
        console.log("db connected");
    })
    .catch((err)=>{
        console.log(err);
    })



export default mongoose;
```

4)Server.js

```
import express from "express";
import path from "path";
const app=express();
const PORT=3001



import http from "http";
const server=http.createServer(app)
import { Server } from "socket.io";

export const io = new Server(server, {
  cors: {
    origin: "http://localhost:3000",
    methods: ["GET", "POST"],
    credentials: true,
  },
});
import socketHandler from "./sockets.js";
socketHandler(io);




app.use(express.json());
// app.use(express.static(path.join(__dirname,"public")));




import cors from "cors";
import cookieParser from "cookie-parser";
app.use(cors({
    origin:"http://localhost:3000",
    credentials:true
}));
app.use(cookieParser());



import {passport} from "./auth.js"
```

```
app.use(passport.initialize());



import multer from "multer";
import storage from "./multer.js";
const upload=multer({storage:storage});


app.use('/uploads', express.static('uploads'));



//Common
import {read_paper} from "./controllers/common.js"
app.post('/read_paper',passport.authenticate('jwt', { session: false }),read_paper)


import {refresh_access_token,signin,signup,logout} from "./controllers/login.js"
app.get('/refresh',refresh_access_token)

app.post('/signin', signin);

app.post('/signup', signup);

app.post('/logout', logout);

//use this is proected routes passport.authenticate('jwt', { session: false }),
import {add_paper,get_user} from "./controllers/user.js"
app.post('/add_paper',passport.authenticate('jwt', { session: false }),upload.single('file'),add_paper)

app.get('/get_user',passport.authenticate('jwt', { session: false }),get_user)
```

```
import {add_moderator,get_papers_to_verify,verify_paper,reject_paper,
bookmark_paper,get_bookmarks,get_moderators,paper_filler} from "./controllers/admin.js"
app.get('/get_moderators',passport.authenticate('jwt', { session: false }),get_moderators)

app.post('/add_moderator',passport.authenticate('jwt', { session: false }),add_moderator)

app.get('/get_papers_to_verify',passport.authenticate('jwt', { session: false }),get_papers_to_verify)

app.post('/verify_paper',passport.authenticate('jwt', { session: false }),verify_paper)

app.post('/reject_paper',passport.authenticate('jwt', { session: false }),reject_paper)

app.post('/bookmark_paper',passport.authenticate('jwt', { session: false }),bookmark_paper)

app.get('/get_bookmarks',passport.authenticate('jwt', { session: false }),get_bookmarks)

app.post('/paper_filler',passport.authenticate('jwt', { session: false }),paper_filler)

import {get_forums,search_for_forum_id,upvote_forum,downvote_forum,comment_forum} from "./controllers/forum.js"
app.get('/get_forums',get_forums)

app.get('/search_for_forum_id',search_for_forum_id)

app.post('/upvote_forum',passport.authenticate('jwt', { session: false }),upvote_forum)

app.post('/downvote_forum',passport.authenticate('jwt', { session: false }),downvote_forum)

app.post('/comment_forum',passport.authenticate('jwt', { session: false }),comment_forum)
server.listen(PORT,()=>{
    console.log("server started");
})
```

5)Controllers

5.1)Admin.js

```
import User from "../models/User.js";

import Paper from "../models/Paper.js";

import Request from "../models/Request.js";

import bcrypt from "bcrypt";

import Admin from "../models/Admin.js";


export const add_moderator=async(req,res,next)=>{

    try{

        console.log("req cam ine (controller.admin.add_moderator)");

        let {name,mail,pass}=req.body

        let hashedpass=await bcrypt.hash(pass,10)

        let user=new Admin({name,mail,pass:hashedpass,role:"admin"})

        await user.save()

        res.json({msg:true,user})

    }catch(e){

        res.json({msg:false,error:e.message,message:"error in adding moderator"})

    }

}


export const get_moderators=async(req,res,next)=>{

    try{

        console.log("req cam ine (controller.admin.get_moderators)");

        let admins=await Admin.find().select("-pass")

        res.json({msg:true,admins})

    }catch(e){

        res.json({msg:false,error:e.message,message:"error in getting moderators"})

    }

}
```

```
export const get_papers_to_verify=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.admin.get_papers_to_verify)");
        let papers=await Request.find()
        res.json({msg:true,papers})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in getting papers to verify"})
    }
}

export const verify_paper=async(req,res,next)=>{
    console.log("req cam ine (controller.admin.verify_paper)");
    try{

        let {requestid}=req.body
        let paperid=req.body.paperid
        console.log(req.body);
        let paper=await Paper.findById(paperid)
        if(!paper) return res.json({msg:false,message:"paper not found"})
        paper.verified=true
        await paper.save()
        await Request.deleteOne({_id:requestid})

        res.json({msg:true,paper})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in verifying paper"})
    }
}

export const reject_paper=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.admin.reject_paper)");
        let {paperid,requestid}=req.body
        let paper=await Paper.findById(paperid)
        if(!paper) return res.json({msg:false,message:"paper not found"})
        paper.verified=false
        await paper.save()
        let request=await Request.deleteOne({_id:requestid})
        request.save()
        res.json({msg:true,paper})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in rejecting paper"})
    }
}

export const bookmark_paper=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.admin.bookmark_paper)");
        let {paperid}=req.body
        let paper=await Request.findById(paperid)
        if(!paper) return res.json({msg:false,message:"paper not found"})
        let userid=req.user
        let user=await User.findById(userid)
        if(!user) return res.json({msg:false,message:"user not found"})
        user.research_paper.push(paperid)
        await user.save()
        res.json({msg:true,user})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in bookmarking paper"})
    }
}

export const get_bookmarks =async(req,res,next)=>{
    try{
        let userid=req.user
        let user=await User.findById(userid).populate("research_paper")
        if(!user) return res.json({msg:false,message:"user not found"})
        res.json({msg:true,bookmarks:user.research_paper})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in getting bookmarks"})
    }
}
export const read_paper=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.admin.read_paper)");
        let {paperid}=req.body
        let paper=await Paper.findById(paperid)
        if(!paper) return res.json({msg:false,message:"paper not found"})


        res.json({msg:true,paper})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in reading paper"})
    }
}



export const paper_filler=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.admin.paper_filler)");
        let paper=req.body.paper

        let research_paper=await Paper.findById(paper.research_paper)
        if(!research_paper) return res.json({msg:false,message:"paper not found"})
        paper.research_paper=research_paper
        res.json({msg:true,paper})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in paper filler"})
    }
```

```
}
```

5.2) Admin.js

```
import User from "../models/User.js";
import Admin from "../models/Admin.js";
import Paper from "../models/Paper.js";
import { fromPath } from "pdf2pic";
import path from "path"
export const read_paper = async (req, res, next) => {
  try {
    console.log("req cam ine (controller.admin.read_paper)");
    let paper = req.body
    let file = await Paper.findById(paper._id)
    file = file.file
    let options = {
      density: 150,
      savePath: null,
      format: "png",
      width: 800,
      height: 1000
    };
    const filePath = path.resolve(file.path).replace(/\\/g, "/");

    const convert = fromPath(filePath, options);

    // convert ALL pages to buffers
    const result = await convert.bulk(-1, { responseType: "base64" });
    console.log(result);
    // result = array of { page: x, base64: "..." }
    // send them to frontend
    res.json({
            msg: true,
            pages: result.map((r) => ({
                page: r.page,
                image: `data:image/png;base64,${r.base64}`,
            })),
        });
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in reading paper" })
    }
}
```

5.3)Forums.js

```
import User from "../models/User.js";
import Paper from "../models/Paper.js";




export const get_forums = async (req, res, next) => {
    try {
        console.log("req cam ine (controller.user.search_for_forum_id)");
        let forums = await Paper.find();
        res.json({ msg: true, forums })
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in gettting forums papers" })
    }
}

export const search_for_forum_id = async (req, res, next) => {
    try {
        console.log("req cam ine (controller.user.search_for_forum_id)");
        let forumid = req.query.forumid
        let forums = await Paper.findById(forumid);
        if (!forums) return res.json({ msg: false, message: "forum not found" })
        forums = await Paper.find({
            name: { $regex: forumid, $options: "i" }
        });
        res.json({ msg: true, forums })
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in gettting forums papers" })
    }
}

export const upvote_forum = async (req, res, next) => {
    try {
        console.log("req cam ine (controller.user.upvote_forum)");
        let forumid = req.query.forumid
        let forums = await Paper.findById(forumid);
        if (!forums) return res.json({ msg: false, message: "forum not found" })
        forums.upvotes++
        await forums.save()
        res.json({ msg: true, forums })
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in gettting forums papers" })
    }
}

export const downvote_forum = async (req, res, next) => {
    try {
        console.log("req cam ine (controller.user.downvote_forum)");
        let forumid = req.query.forumid
        let forums = await Paper.findById(forumid);
        if (!forums) return res.json({ msg: false, message: "forum not found" })
        forums.downvotes++
        await forums.save()
        res.json({ msg: true, forums })
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in gettting forums papers" })
    }
}

export const comment_forum = async (req, res, next) => {
    try {
        console.log("req cam ine (controller.user.comment_forum)");
        let forumid = req.body.forumid
        let forums = await Paper.findById(forumid);
        if (!forums) return res.json({ msg: false, message: "forum not found" })
        let name = await User.findById(req.user).select("name -_id")
        let reply = req.body.reply
        let comment = { name:name.name, reply }
        forums.replies.push(comment)
        await forums.save()
        res.json({ msg: true, comment })
    } catch (e) {
        res.json({ msg: false, error: e.message, message: "error in gettting forums papers" })
    }
}
```

5.4)Login.js

```
import jwt from "jsonwebtoken";
import passport from "passport";

import { SECRET_KEY } from "../auth.js"

import User from "../models/User.js"
import bcrypt from "bcrypt";
```

```
export const signin = (req, res, next) => {
  passport.authenticate('local', { session: false }, (err, user, info) => {
    if (err) return next(err);
    if (!user) {
      return res.status(401).json({ message: info.message || 'Login failed' });
    }
    const payload = { id: user.id, username: user.username };
    const ref_token = jwt.sign(payload, SECRET_KEY, { expiresIn: '7d' });
    const access_token = jwt.sign({ id: user.id }, SECRET_KEY, { expiresIn: '1d' });
    res.cookie("token", ref_token, {
      httpOnly: true,
      secure: true,
      sameSite: "Strict",
      maxAge: 7 * 24 * 60 * 60 * 1000
    })
    res.json({ message: 'Login successful', access_token });
  })(req, res, next);
}

export const signup = (async (req, res, next) => {
  try {
    const { name, pass, mail } = req.body;
    const hashedpass = await bcrypt.hash(pass, 10);
    const user = new User({ name, pass: hashedpass, mail });
    await user.save();
    res.status(201).json({ message: 'Signup successful' });
  } catch (err) {
    res.status(500).json({ error: err.message, msg: false });
  }
})

export const refresh_access_token=async(req,res,next)=>{
  const token = req.cookies.token;
  if(!token) return res.status(401).json({ message: 'Unauthorized' });
  try {
    const payload = jwt.verify(token, SECRET_KEY);
    const user = await User.findById(payload.id);
    if (!user) return res.status(401).json({ message: 'Unauthorized' });
    const access_token = jwt.sign({ id: user.id }, SECRET_KEY, { expiresIn: '1d' });
    res.json({ message: 'Token refreshed', access_token,msg:true });
  } catch (err) {
    res.status(401).json({ message: 'Unauthorized' });
  }
}

export const logout = (req, res) => {
  //   req.logout(err => {
  //     if (err) return res.status(500).send('Logout error');
  //     req.session.destroy(() => {
  //       res.clearCookie('connect.sid');
  //       res.send('Logged out');
  //     });
  //   });
}
```

5.5)User.js

```
import User from "../models/User.js";
import Paper from "../models/Paper.js";
import Request from "../models/Request.js";



export const add_paper=async(req,res,next)=>{
    try{
```

```
console.log("req cam ine (controller.user.add_paper)",req.file);
let {name,description}=req.body
let userid=req.user
let file=req.file
if(!userid) return res.json({msg:false,message:"user not found"})
let user=await User.findById(userid)



let paper=new Paper({
   title:name,
   description,
   refrence_links:[],
   organization:user.organization,
   verified:false,
   verified_by:"",upvote:0,downvote:0,
   replies:[],file
})
await paper.save()
let request=new Request({
   name:user.name,
   mail:user.mail,
   organization:user.organization,
   research_paper:paper._id,
   userid:user._id,
   name,
   description,
   paperid:paper._id,
})
await request.save()

user.research_paper.push(paper._id)
await user.save()
```

```
        res.json({msg:true,message:"paper added successfully"})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in adding paper"})
    }
}

export const get_user=async(req,res,next)=>{
    try{
        console.log("req cam ine (controller.user.get_user)");
        let userid=req.user
        if(!userid) return res.json({msg:false,message:"user not found"})
        let user = await User.findById(userid).select("name mail organization role").populate("research_paper");
        res.json({msg:true,user})
    }catch(e){
        res.json({msg:false,error:e.message,message:"error in getting user"})
    }
}
```

Frontend:-

1)App.js

```
import logo from './logo.svg';
import './App.css';
import { useEffect, useRef,useState } from 'react';
import { io } from 'socket.io-client';
import { useDispatch,useSelector } from 'react-redux';
import Navbar from './components/Navbar/Navbar';
import Content from './components/Content/Content';
import { useNavigate } from 'react-router-dom';
function App() {
```

```
let [socket, setSocket] = useState(null);
let dispatch=useDispatch();
let naviagter=useNavigate();
let token = useSelector((state) => state.token);
useEffect(() => {
  const newSocket = io("http://localhost:3001", {
    autoConnect: false,
  });
  console.log("token is ",token)
  setSocket(newSocket);
  return () => {
    if (newSocket) {
      newSocket.disconnect();
    }
  };
}, []);


useEffect(() => {
  if (socket) {

    socket.on("connect", () => {
      console.log("✅Connected to socket:", socket.id);
    });

    socket.on("disconnect", () => {
      console.log("❌Disconnected from socket");
    });
  }
}, [socket]);
```

```
  return (
    <>
      <div className="nav_con">
          <Navbar/>
      </div>

      <div className='header'>
        <p
style={{color:"#5a5a5aff",margin:"0px",padding:"0px",width:"50%",textAlign:"justify",fontWeight:"bolder",fontSize:"25px"}}>
Lorem ipsum dolor sit amet consectetur adipisicing elit. Necessitatibus
          id ipsam sapiente ex quasi et nostrum suscipit
          culpa exercitationem eos? Eius itaque
          deserunt officiis, magnam
          doloremque earum. Neque, animi nam?  <button onClick={()=>naviagter("/content")}> Learn More</button></p>

      </div>



      <div className='about_con'>
        <div>
          <h2>About Us</h2>
        </div>
      </div>

    </>
  );
}

export default App;
```

CSS:-

```
.nav_con{
  height: 5vh;
  background-color: #F5F6BF;
  display: flex;
  flex-direction: row;
  justify-content: space-between;
  box-sizing: border-box;
  padding: 10px;
  align-items: center;
}
.header{
  display: flex;
  flex-direction: row;
  gap: 10px;
  height: calc(40vh - 5vh);
  align-items: center;
  box-sizing: border-box;
  padding: 50px;
  background-image: url("../public/Gemini_Generated_Image_3f1w8d3f1w8d3f1w.png");
  background-color: #f9fad1;
  background-position: right;
  background-repeat: no-repeat;
}
.about_con{
  background-color: antiquewhite;
  height: 40vh;
}
```

2)Index.js

```
import React from 'react';

import ReactDOM from 'react-dom/client';

import './index.css';

import App from './App';

import reportWebVitals from './reportWebVitals';

import {Provider} from 'react-redux'

import { createBrowserRouter,RouterProvider } from 'react-router-dom';

import { store } from './redux/store';

import Login from './components/login/Login';

import Admin from './components/Admin/Admin';

import Forums from './components/Forums/Forums';

import Content from './components/Content/Content';

import User from './components/User/User';

import Verify from './components/Admin/Verify';

const router=createBrowserRouter([

  {

    path:"/",

    element:<Login/>

  },

  {

    path:"/home",

    element:<App/>

  },

  {

    path:"/admin",

    element:<Admin/>

  },

  {

    path:"/forums",

    element:<Forums/>

  },

  {

    path:"/content",
    element:<Content/>
  },
  {
    path:"/user",
    element:<User/>
  },
  {
    path:"/verify",
    element:<Verify/>
  }
])
const root = ReactDOM.createRoot(document.getElementById('root'));
root.render(
  <React.StrictMode>
    <Provider store={store}>
    <RouterProvider router={router} />
    </Provider>
  </React.StrictMode>
);

// If you want to start measuring performance in your app, pass a function
// to log results (for example: reportWebVitals(console.log))
// or send to an analytics endpoint. Learn more: https://bit.ly/CRA-vitals
reportWebVitals();
```

2)Admin component

2.1)Admin.js

```
import React, { useEffect, useRef, useState } from 'react'
import Navbar from '../Navbar/Navbar'
import { useSelector } from 'react-redux'
import { useNavigate } from 'react-router-dom';


const Admin = () => {
  let token=useSelector((state) => state.token);
  let naviagte=useNavigate()



  let [toggle,settoggle]=useState("verify")
  let [paper,setpaper]=useState([]);
  let [bookmarks,setbookmark]=useState([]);
  useEffect(() => {
    console.log(token);
    fetch('http://localhost:3001/get_papers_to_verify', {
      method: 'GET',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': `Bearer ${token}`
      }
    })
    .then(res => res.json())
    .then(data => {
      console.log(data);
      if(data.msg){
        setpaper(data.papers)
      }
    })
    .catch(err => console.error(err));



    fetch('http://localhost:3001/get_bookmarks', {
      method: 'GET',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': `Bearer ${token}`
      }
    })
    .then(res => res.json())
    .then(data => {
      console.log(data);
      if(data.msg){
        setbookmark(data.bookmarks)
      }
    })
    .catch(err => console.error(err));



    fetch('http://localhost:3001/get_moderators', {
      method: 'GET',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': `Bearer ${token}`
      }
    })
    .then(res => res.json())
    .then(data => {
      console.log(data);
    })
    .catch(err => console.error(err));
  }, [])



  let nameref=useRef()
  let passref=useRef()
  let mailref=useRef()

  let handleMod=()=>{

    fetch('http://localhost:3001/add_moderator', {

      method: 'POST',

      credentials: 'include',

      headers: {

        'Content-Type': 'application/json',

        'Authorization': `Bearer ${token}`

      },

      body: JSON.stringify({

        name:nameref.current.value,

        pass:passref.current.value,

        mail:mailref.current.value

      })

    })

    .then(res => res.json())

    .then(data => {

      console.log(data);

    })

    .catch(err => console.error(err));

  }

  return (

    <>

    <div className="nav_con"><Navbar/></div>


    <div>

  <button onClick={() => settoggle("verify")}>Verify Papers</button>

  <button onClick={() => settoggle("moderators")}>Manage Moderators</button>

  <button onClick={() => settoggle("bookmark")}>Manage Bookmarks</button>

</div>


{/* Verify Papers Section */}

{toggle === "verify" && (
  <ul>
    {paper &&
      paper.map((p, index) => (
        <li
          key={index}
          onClick={() => {console.log(p);
            naviagte(`/verify`, { state: { paper: p } });
          }}
        >
          <h3>{p.title}</h3>
          <p>{p.description}</p>
          <span>{p.verified ? "✅Verified" : "❌Not Verified"}</span>
        </li>
      ))}
  </ul>
)}

{/* Moderators Section */}
{toggle === "moderators" && (
  <>
    <input ref={nameref} type="text" placeholder="username" />
    <input ref={mailref} type="text" placeholder="email" />
    <input ref={passref} type="text" placeholder="password" />
    <button onClick={handleMod}>Add mod</button>
  </>
)}

{/* Bookmarks Section */}
{toggle === "bookmark" && (
  <ul>
    {bookmarks &&
      bookmarks.map((bookmark, index) => (
        <li  onClick={() => {
```

```
      naviagte(`/verify`, { state: { bookmark: bookmark } });
     }} key={index}>
     <h3>{bookmark.title}</h3>
     <p>{bookmark.description}</p>
     <span>{bookmark.verified ? "✅Verified" : "❌Not Verified"}</span>
    </li>
   ))}
 </ul>
)}





  </>
 )
}

export default Admin
```

2.2)Verify.js

```
import React, { useEffect, useState } from 'react'
import { useSelector } from 'react-redux';
import { useLocation } from 'react-router-dom';

const Verify = () => {
  let location=useLocation()
  let {paper}=location.state || {}
  let [Paper,setpaper]=useState()
  let token = useSelector((state) => state.token);
  useEffect(() => {
   console.log(paper);
```

```
    fetch('http://localhost:3001/paper_filler', {
      method: 'POST',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json'
      },
      body: JSON.stringify({
        paper
      })
    })
    .then(res => res.json())
    .then(data => {
      console.log(data);
      if(data.msg){
        setpaper(data.paper)
      }
    })
    .catch(err => console.error(err));
}, [])



let handlebookmark=()=>{
    fetch('http://localhost:3001/bookmark_paper', {
      method: 'POST',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': `Bearer ${token}`
      },
      body: JSON.stringify({paperid:paper._id})
    })
    .then(res => res.json())
```

```
        .then(data => {
          console.log(data);
        })
        .catch(err => console.error(err));
    }



    let handleverify=()=>{
      fetch('http://localhost:3001/verify_paper', {
        method: 'POST',
        credentials: 'include',
        headers: {
          'Content-Type': 'application/json',
          'Authorization': `Bearer ${token}`
        },
        body: JSON.stringify({
          requestid:Paper._id,paperid:Paper.paperid
        })
      })
      .then(res => res.json())
      .then(data => {
        console.log(data);
      })
      .catch(err => console.error(err));
    }
  return (
    <>
    <button onClick={handlebookmark}>bookmark</button>



    <button onClick={handleverify}>Verify</button>
    {Paper && <iframe src={`http://localhost:3001/${Paper.research_paper.file.path}`} width="100%" height="600px" title="PDF Viewer"></iframe>}
    </>
  )
}

export default Verify
```

3)Content component

3.1)Content.js

```
import React, { useState } from 'react'
import Navbar from '../Navbar/Navbar'
import Air_content from './Air_content'
import Water_content from './Water_content'
import Soil_content from './Soil_content'
import Env_content from './Env_content'
import "./Content.css"
const Content = () => {
  let topics = [
    { topic: "Environmental Pollution", content: <Env_content /> },
    {
      topic: "Types", subs: [
        { sub_topic: "Air Pollution", content: <Air_content /> },
        { sub_topic: "Water Pollution", content: <Water_content /> },
        { sub_topic: "Soil Pollution", content: <Soil_content /> }
      ]
    },
    { topic: "Case Studies", subs: [] }
  ]
```

```
let [topic, setTopic] = useState(topics[0])

let [sub_topic, setSubTopic] = useState()




return (

  <>

    <div className='nav_con'>

      <Navbar />

    </div>



    <div className='content_con'>


      <div className='content_list'>

          <h3 style={{padding:"0px",margin:"20px 0 0 10px"}}>Table of content</h3>

          <ul style={{listStyle:"none",padding:"20px",margin:"0px",display:"flex",flexDirection:"column",gap:"8px"}}>

            {topics.map((item, index) => (

              <li key={index}>

                <div onClick={() => {setTopic(item);setSubTopic(item.subs && item.subs[0])}}>{item.topic}</div>

                {item.topic === topic.topic && item.subs && item.subs.length > 0 && (

                  <ul>

                    {item.subs.map((sub, idx) => (

                      <li key={idx} onClick={() => setSubTopic(sub)}>

                        {sub.sub_topic}

                      </li>

                    ))}

                  </ul>

                )}

              </li>

            ))}

          </ul>

      </div>
```

```
        <div className="right">
          {sub_topic ? sub_topic.content : topic.content}
        </div>


      </div>
    </>
  )
}

export default Content
```

3.2)Content.css

```
.content_con {
    display: flex;
    flex-direction: row;
    width: 100%;


    height: calc(100vh - 5vh);
    background-color: yellowgreen;
}

.content_list {
    box-sizing: border-box;
    background-color: turquoise;
}

.right {
    flex: 1;
    overflow-y: auto;
    overflow-x: hidden;
    box-sizing: border-box;
}
```

3.3)Air content.js

```
import React from 'react'
import "./Content.css"

const Air_content = () => {
  return (
   <>
      <h2>Air Pollution</h2>

      <h3>Definition</h3>
      <p>
        Air pollution refers to the presence of harmful substances in the atmosphere
        that alter its natural composition, causing adverse effects on human health,
        environment, and climate.
      </p>

      <h3>Types</h3>
      <ul>
        <li><b>Natural Pollution:</b> Volcanic eruptions, forest fires, dust storms.</li>
        <li><b>Anthropogenic Pollution:</b> Industrial emissions, vehicular exhaust, agriculture.</li>
        <li><b>Primary Pollutants:</b> Emitted directly (CO, SO₂, NOₓ, PM).</li>
        <li><b>Secondary Pollutants:</b> Formed in atmosphere (ozone, smog, PAN).</li>
        <li><b>Indoor & Outdoor Pollution:</b> Household smoke, chemicals, industrial smog.</li>
      </ul>

      <h3>Causes</h3>
      <ul>
        <li>Industrialization and factory emissions</li>
        <li>Vehicular exhaust gases</li>
        <li>Burning of fossil fuels (coal, petrol, diesel)</li>
        <li>Agricultural activities (fertilizers, pesticides, stubble burning)</li>
        <li>Deforestation and household waste burning</li>
      </ul>

      <h3>Effects</h3>
      <ul>
        <li><b>On Health:</b> Respiratory issues, heart problems, eye/skin irritation.</li>
        <li><b>On Environment:</b> Global warming, acid rain, ozone depletion, smog.</li>
        <li><b>On Economy:</b> Healthcare costs, reduced crop yield, infrastructure damage.</li>
      </ul>

      <h3>Control Measures</h3>
      <ul>
        <li><b>Individual:</b> Use public transport, conserve energy, plant trees, avoid burning waste.</li>
        <li><b>Industrial:</b> Install filters/scrubbers, shift to renewable energy, promote electric vehicles.</li>
        <li><b>Government:</b> Enforce air quality laws, afforestation drives, awareness programs.</li>
      </ul>
    </>
  )
}

export default Air_content
```

3.4)Env_Content.js

```
import React from 'react'
import "./Content.css"

const Env_content = () => {
  return (
    <div className="content-container">
      <h2>Environmental Pollution</h2>
```

```
<h3>Definition</h3>
<p>
  Environmental pollution refers to the introduction of harmful substances or pollutants
  into the natural environment, including air, water, and soil, that cause adverse effects
  on living organisms, ecosystems, and climate.
</p>

<h3>Types</h3>
<ul>
  <li><b>Air Pollution:</b> Contamination of the atmosphere by harmful gases, smoke, or particulate matter.</li>
  <li><b>Water Pollution:</b> Contamination of rivers, lakes, oceans, and groundwater by chemicals, sewage, and waste.</li>
  <li><b>Soil Pollution:</b> Degradation of soil quality by chemicals, waste, or radioactive materials.</li>
  <li><b>Noise Pollution:</b> Excessive sound from vehicles, industries, and urban areas affecting human health.</li>
  <li><b>Thermal Pollution:</b> Rise in temperature of natural water bodies or air due to human activity.</li>
  <li><b>Radioactive Pollution:</b> Release of radioactive substances from nuclear plants or accidents.</li>
  <li><b>Light Pollution:</b> Excessive artificial lighting disturbing ecosystems and human sleep cycles.</li>
</ul>

<h3>Causes</h3>
<ul>
  <li>Industrial emissions and effluents</li>
  <li>Vehicular exhaust and urbanization</li>
  <li>Deforestation and land degradation</li>
  <li>Use of chemical fertilizers and pesticides</li>
  <li>Improper waste disposal and littering</li>
  <li>Nuclear and chemical accidents</li>
  <li>Excessive use of fossil fuels and energy consumption</li>
</ul>

<h3>Effects</h3>
<ul>
  <li><b>On Human Health:</b> Respiratory problems, cardiovascular diseases, cancers, neurological disorders.</li>
```

```
        <li><b>On Ecosystems:</b> Loss of biodiversity, habitat destruction, soil degradation, water contamination.</li>
        <li><b>On Climate:</b> Global warming, acid rain, ozone depletion, and changes in rainfall patterns.</li>
        <li><b>On Economy:</b> Reduced agricultural yield, increased healthcare costs, damage to infrastructure, loss of natural resources.</li>
      </ul>

      <h3>Control Measures</h3>
      <ul>
        <li><b>Individual:</b> Reduce, reuse, recycle waste; use public transport or eco-friendly vehicles; plant trees; conserve resources.</li>
        <li><b>Industrial/Technological:</b> Install pollution control devices; treat wastewater and effluents; adopt renewable energy; reduce noise, light, and thermal emissions.</li>
        <li><b>Government/Policy:</b> Enforce environmental laws; promote afforestation and conservation; conduct awareness campaigns; encourage sustainable urban planning.</li>
      </ul>
    </div>
  )
}

export default Env_content
```

3.5)Soil_Content.js

```
import React from 'react'
import "./Content.css"

const Soil_content = () => {
  return (
    <>
      <h2>Soil Pollution</h2>

      <h3>Definition</h3>
      <p>
  Soil pollution is the contamination of soil with harmful chemicals, waste, or other pollutants
  that degrade its quality, reduce fertility, and negatively impact plants, animals, and human health.
</p>

<h3>Types</h3>
<ul>
  <li><b>Industrial Pollution:</b> Deposition of chemicals, heavy metals, and hazardous waste.</li>
  <li><b>Agricultural Pollution:</b> Excessive use of fertilizers, pesticides, and herbicides.</li>
  <li><b>Urban Pollution:</b> Solid waste dumping, plastics, and construction debris.</li>
  <li><b>Radioactive Pollution:</b> Leakage of radioactive substances from nuclear plants.</li>
  <li><b>Biological Pollution:</b> Sewage sludge and pathogenic organisms contaminating soil.</li>
</ul>

<h3>Causes</h3>
<ul>
  <li>Excessive use of chemical fertilizers and pesticides</li>
  <li>Industrial waste and effluent discharge into land</li>
  <li>Deforestation and soil erosion</li>
  <li>Improper disposal of plastics, e-waste, and solid waste</li>
  <li>Mining and quarrying activities</li>
  <li>Oil spills and leakage of toxic substances</li>
</ul>

<h3>Effects</h3>
<ul>
  <li><b>On Human Health:</b> Diseases due to contaminated crops, water, and dust inhalation.</li>
  <li><b>On Soil Fertility:</b> Loss of nutrients, reduced agricultural productivity.</li>
  <li><b>On Environment:</b> Disruption of ecosystems, contamination of groundwater, biodiversity loss.</li>
</ul>

<h3>Control Measures</h3>
<ul>
  <li><b>Individual:</b> Reduce plastic use, adopt organic farming, proper waste disposal.</li>
```

```
        <li><b>Industrial:</b> Safe disposal of hazardous waste, eco-friendly manufacturing.</li>
        <li><b>Government:</b> Enforce soil protection laws, promote afforestation,
            recycling programs, awareness campaigns.</li>
      </ul>
    </>
  )
}

export default Soil_content
```

3.6)Water_Content.js

```
import React from 'react'
import "./Content.css"

const Water_content = () => {
  return (
    <>
      <h2>Water Pollution</h2>

      <h3>Definition</h3>
      <p>
        Water pollution is the contamination of water bodies such as rivers, lakes, oceans, and groundwater
        by harmful substances, making the water unsafe for human use, agriculture, industry, and aquatic life.
      </p>

      <h3>Types</h3>
      <ul>
        <li><b>Point Source Pollution:</b> Direct discharge from factories, sewage pipes.</li>
        <li><b>Non-Point Source Pollution:</b> Runoff from fields, streets, and urban areas.</li>
        <li><b>Chemical Pollution:</b> Fertilizers, pesticides, heavy metals, industrial waste.</li>
        <li><b>Biological Pollution:</b> Pathogens like bacteria, viruses, parasites.</li>
        <li><b>Thermal Pollution:</b> Hot water from industries and power plants.</li>
        <li><b>Plastic Pollution:</b> Plastics and microplastics in rivers and oceans.</li>
      </ul>

      <h3>Causes</h3>
      <ul>
        <li>Industrial waste discharge into water bodies</li>
        <li>Sewage and domestic waste</li>
        <li>Agricultural runoff with fertilizers and pesticides</li>
        <li>Oil spills and marine dumping</li>
        <li>Deforestation and soil erosion</li>
        <li>Improper disposal of plastics and other wastes</li>
      </ul>

      <h3>Effects</h3>
      <ul>
        <li><b>On Human Health:</b> Waterborne diseases, heavy metal poisoning, organ damage.</li>
        <li><b>On Aquatic Life:</b> Eutrophication, fish kills, bioaccumulation of toxins.</li>
        <li><b>On Environment & Economy:</b> Loss of biodiversity, reduced clean water availability,
            economic losses in fishing, farming, and tourism.</li>
      </ul>

      <h3>Control Measures</h3>
      <ul>
        <li><b>Individual:</b> Avoid dumping waste, use eco-friendly products, conserve water.</li>
        <li><b>Industrial:</b> Treat sewage/effluents, adopt sustainable farming, clean oil spills.</li>
        <li><b>Government:</b> Enforce water pollution laws, river cleaning projects, promote rainwater harvesting,
            awareness campaigns.</li>
      </ul>
    </>
  )
}

export default Water_content
```

4)Dashboad component

4.1)dashboard.js

```
import React from 'react'
import Navbar from '../Navbar/Navbar'

const Dashboard = () => {
  return (
    <>
    <div className='nav_con'>
        <Navbar/>
    </div>



    <div>
        <span>user name</span>
        <span>is verified?</span>
        <span>any org?</span>
    </div>

    <h3>All papers</h3>
    <div>
        <ul>
            {}
        </ul>
    </div>
    </>
```

```
 )
}

export default Dashboard
```

5)Forums component

5.1)Forums.js

```
import React, { use, useEffect, useRef, useState } from 'react'
import Navbar from '../Navbar/Navbar'
import "./forums.css"
import { useSelector } from 'react-redux';
import Replies from './Replies';
const Forums = () => {
  let token = useSelector((state) => state.token);
  useEffect(() => {
    fetch('http://localhost:3001/get_forums', {
      method: 'GET',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json',
        'Authorization': `Bearer ${token}`
      }
    })
    .then(res => res.json())
    .then(data => {
      console.log(data);
      if (data.msg) {
        setpapers(data.forums);
      }
    })
    .catch(err => console.error(err));
  }, [])



  let searchRef = useRef()
  let handleSearch = () => {
    console.log("value being searched ", searchRef.current.value)
    fetch('http://localhost:3001/search_for_forum_id?forumid=' + searchRef.current.value, {
      method: 'GET',
      credentials: 'include',
      headers: {
        'Content-Type': 'application/json'
      }
    })
      .then(res => res.json())
      .then(data => {
        console.log(data);
        if (data.msg) {

        }
      })
      .catch(err => console.error(err));
  }


  let [papers, setpapers] = useState([]);


  let [showreply,setreply]=useState("")
  return (
    <>
```

```
      <div className='nav_con'>
        <Navbar />
      </div>




      <h1>Forums</h1>
      <div className='search'>
        <div style={{ borderRadius: "76px", backgroundColor: "green", display: "flex", flexDirection: "row", padding: "0 19px 0 19px", justifyContent: "center", alignItems: "center", boxSizing: "border-box" }}>
          <input style={{ borderRadius: "76px", border: "none", background: "none" }} ref={searchRef} type="text" placeholder='Enter refrence id' onKeyDown={handleSearch} />
          <button style={{ borderRadius: "76px", border: "none", background: "none" }} onClick={handleSearch}>Search</button>
        </div>
      </div>



      <div className='papers'>
        <ul>
          {papers && papers.map((paper, index) => {
            return (
              <>
              <li key={index}>
                <span>{paper.title} paper Titile</span>
                <span>{paper.description} paper Description</span>

                <span>{paper.refrence_links}refrence_links</span>

                <span>{paper.verified}verified??</span>
                <span>{paper.verified_by}verified_by</span>

                <span>{paper.organization}organization</span>
        <span>{paper.user}click user to see all teh papers</span>
       </li>
       <button onClick={()=>{setreply(paper)}}>View  reply</button>
       {showreply && showreply._id===paper._id && (
        <>
        <Replies paper={paper}/>
        </>
       )}
       </>
      )
     })}
    </ul>
   </div>
  </>

 )
}

export default Forums
```

5.2)Replies.js

```
import React, { useReducer, useRef } from 'react'
import { useSelector } from 'react-redux';

const Replies = ({ paper }) => {
  let replyref = useRef()
  let token = useSelector((state) => state.token);
  const [_, forceRender] = useReducer((x) => x + 1, 0);
  let handlereply = () => {
    console.log(replyref.current.value);
    fetch('http://localhost:3001/comment_forum', {
     method: 'POST',
     credentials: 'include',
     headers: {
       'Content-Type': 'application/json',
       'Authorization': `Bearer ${token}`
     },
     body: JSON.stringify({
       reply:replyref.current.value,
       forumid:paper._id
     })
    })
    .then(res => res.json())
    .then(data => {
     console.log(data);
     if(data.msg){
       paper.replies.push(data.comment)
       replyref.current.value = ''
       forceRender()
     }
    })
    .catch(err => console.error(err));
  }
  return (
    <>
       <div>
           <input ref={replyref} type="text" placeholder='reply' />
           <button onClick={() => { handlereply()}}>reply</button>
       </div>



       <ul>
           {paper.replies.length > 0 && paper.replies.map((reply,index) => {
               return(
                   <>
```

```
                        <li key={index}>
                            <span>{reply.name}</span>
                            <span>{reply.reply}</span>
                        </li>
                        </>
                    )
                })}
            </ul>
        </>
    )
}

export default Replies
```

5.3)Forums.css

```
.search{
    background-color: yellow;
    display: flex;
    flex-direction: row;
    justify-content: center;
    height: 5vh;
}

.papers{
    background-color: brown;
}
```

6)Navbarcomponent

6.1)Navabr.js

```
import React from 'react'
import { useNavigate } from 'react-router-dom'


const Navbar = () => {
    let navigate=useNavigate()
    return (
        <>
            <div onClick={()=>{navigate("/home")}}>
                <span>logo</span>
                <span>wbsite name</span>
            </div>



            <div>
                <button onClick={()=>{navigate("/forums")}}>Forums</button>
                <button onClick={()=>{navigate("/admin")}}>admin</button>
                <button onClick={()=>{navigate("/user")}}>user</button>
                {/* <button onClick={()=>{navigate("/")}}>Login</button> */}
            </div>
        </>
    )
}

export default Navbar
```

6.2)nav.css

7)User component

```
import React, { useEffect, useRef, useState } from 'react'
import Navbar from '../Navbar/Navbar'
import { useSelector } from 'react-redux'
const User = () => {
```

```
let nameref=useRef()
let descriptionref=useRef()
let fileref=useRef()
let token = useSelector((state) => state.token);
let handlepaper=()=>{
  console.log(nameref.current.value,descriptionref.current.value)
  let formdata=new FormData()
  formdata.append('file',fileref.current.files[0])
  formdata.append('name',nameref.current.value)
  formdata.append('description',descriptionref.current.value)
  fetch('http://localhost:3001/add_paper', {
    method: 'POST',
    credentials: 'include',
    headers: {
      "Authorization": `Bearer ${token}`
    },
    body: formdata
  })
  .then(res => res.json())
  .then(data => {
    console.log(data);
  })
  .catch(err => console.error(err));
}

let [user,setuser]=useState()
useEffect(() => {
  fetch('http://localhost:3001/get_user', {
    method: 'GET',
    credentials: 'include',
    headers: {
      'Content-Type': 'application/json',
      'Authorization': `Bearer ${token}`
    }
  })
  .then(res => res.json())
  .then(data => {
    console.log(data);
    if(data.msg){
      setuser(data.user)


    }
  })
  .catch(err => console.error(err));
}, [])




let handlePaper=(paper)=>{


}
return (
  <>
  <div className='nav_con'>
      <Navbar/>
  </div>



  <div>
      <span>user name</span>
      <span>is verified?</span>
      <span>any org?</span>
  </div>



  <input type="text" placeholder='Paper name' ref={nameref}/>
  <textarea placeholder='Paper description' ref={descriptionref}/>
  <input type='file' ref={fileref}/>
  <button onClick={()=>{handlepaper()}}>Submit</button>



  <h3>All papers</h3>
  <div>
    <ul>
      {user && user.research_paper.map((paper,index)=>{
       return (
       <li key={index} onClick={()=>{handlePaper(paper)}}>
         <p>{paper.title}</p>
         <p>{paper.description}</p>
         {paper.verified ? <p>verified</p> : <p>not verified</p>}
         {paper.verified && <p>verified by {paper.verified_by}</p>}
       </li>)

      })}
    </ul>
  </div>
  </>
 )
}

export default User
```

7)Login component

7.1)Login.js

```
import React, { useEffect, useState } from 'react';
import './login.css';
import { useNavigate } from 'react-router-dom';


import { useDispatch } from 'react-redux';
import { jwtToken } from '../../redux/slices/token';



const Login = () => {
  const [isSignup, setIsSignup] = useState(false);
  const [form, setForm] = useState({
    username: '',
    mail: '',
    password: ''
  });
  const [errorMsg, setErrorMsg] = useState('');
  let dispatch = useDispatch();

  let navigate=useNavigate()



  const handleChange = (e) => {
    setForm({ ...form, [e.target.name]: e.target.value });
    setErrorMsg('');
  };




  const handleSubmit = () => {

    const url = isSignup ? 'http://localhost:3001/signup' : 'http://localhost:3001/signin';
    const { username, mail, password } = form;

    if (!username.trim() || !mail.trim() || !password.trim()) {
      setErrorMsg('All fields are required.');
      return;
    }

    const emailRegex = /^[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+\.[a-zA-Z]{2,}$/;
    if (!emailRegex.test(mail)) {
      setErrorMsg('Please enter a valid email address.');
      return;
    }

    fetch(url, {
      method: 'POST',
      headers: { 'Content-Type': 'application/json' },
      credentials: 'include',
      body: JSON.stringify({ name:username, mail, pass:password })

    })
      .then(res => res.json())
      .then(data => {

        if (data.message === 'Login successful') {
          console.log(data);
          dispatch(jwtToken(data.access_token))
          navigate('/home');
        }
        if(data.message==="Signup successful"){
          console.log(data.message);
        }else{
          setErrorMsg(data.message);
        }

      })
      .catch(err => {
        console.error(err);
```

```
     setErrorMsg('Wrong Credentials');
    });
  };

  return (
   <div className="login-background">
    <div className="login-card">
     <h2>{isSignup ? 'Sign Up' : 'Sign In'}</h2>

     <input
      type="text"
      name="username"
      placeholder="Username"
      value={form.username}
      required
      onChange={handleChange}
     />

     <input
      type="email"
      name="mail"
      placeholder="Email"
      value={form.mail}
      required
      onChange={handleChange}
     />

     <input
      type="password"
      name="password"
      placeholder="Password"
      value={form.password}
      required
```

```
          onChange={handleChange}
        />

        <button onClick={handleSubmit}>
          {isSignup ? 'Create Account' : 'Log In'}
        </button>

        {errorMsg && <p className="error-message">{errorMsg}</p>}

        <p>
          {isSignup ? 'Already have an account?' : "Don't have an account?"}
          <span onClick={() => {
            setIsSignup(!isSignup);
            setErrorMsg('');
          }}>
            {isSignup ? ' Sign In' : ' Sign Up'}
          </span>
        </p>
      </div>
    </div>
  );
};

export default Login;
```

7.2)Login.css

```
.login-background {
  height: 100vh;
  display: flex;
  justify-content: center;
  align-items: center;
  background: linear-gradient(135deg, #e0eafc, #cfdef3);
```

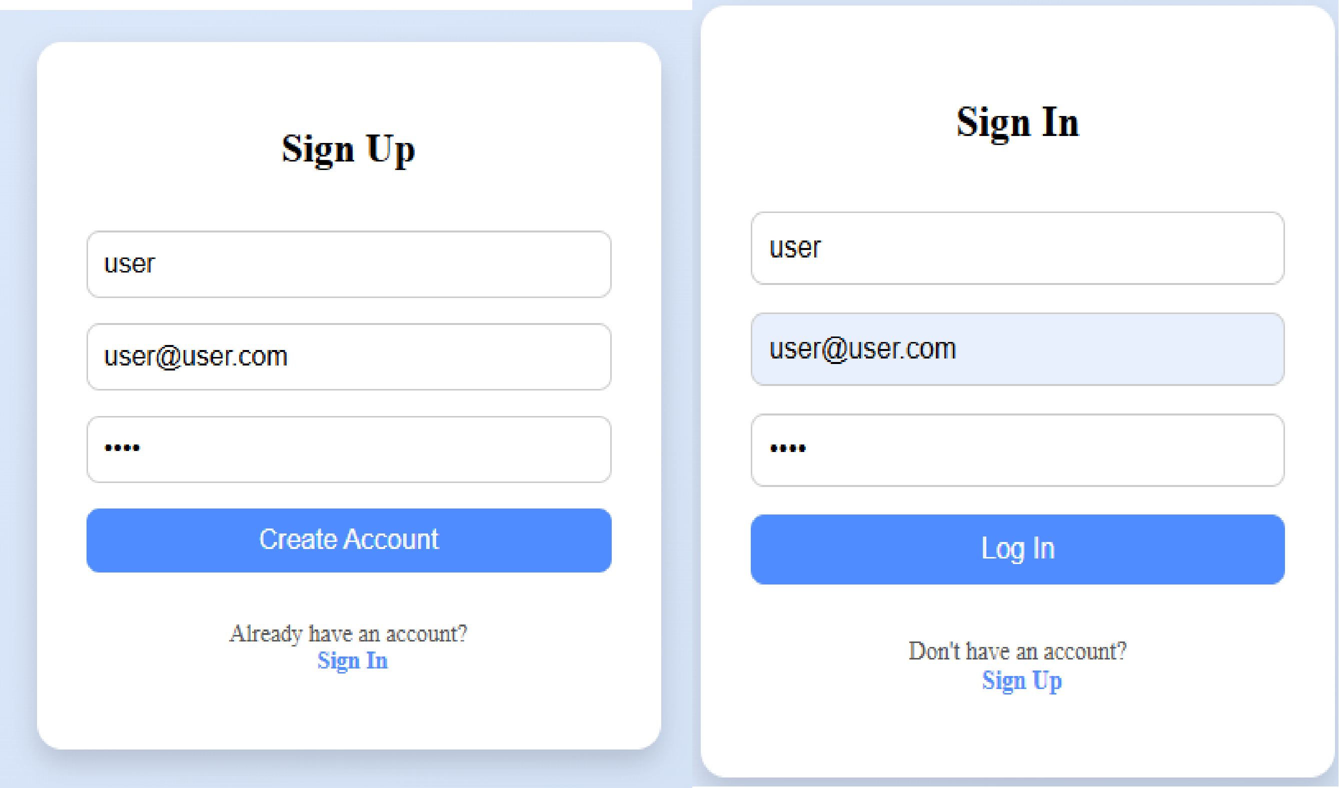
```
}

.login-card {
  background: white;
  padding: 30px;
  border-radius: 15px;
  box-shadow: 0 8px 16px rgba(0,0,0,0.15);
  width: 320px;
  display: flex;
  flex-direction: column;
  gap: 15px;
  text-align: center;
}

.login-card input {
  padding: 10px;
  font-size: 16px;
  border-radius: 8px;
  border: 1px solid #ccc;
}

.login-card button {
  padding: 10px;
  background-color: #4e8cff;
  color: white;
  border: none;
  border-radius: 8px;
  font-size: 16px;
  cursor: pointer;
}

.login-card button:hover {
  background-color: #3a6edc;
```

```
}


.login-card p {
  font-size: 14px;
  color: #555;
}


.login-card span {
  color: #4e8cff;
  font-weight: bold;
  cursor: pointer;
  margin-left: 5px;
}
.error-message {
  color: red;
  font-size: 14px;
  margin-top: -10px;
  margin-bottom: 10px;
}
```

OUTPUT:

1)Registering User and Admin

1.1)User



Sign Up

user

user@user.com

••••

Sign In

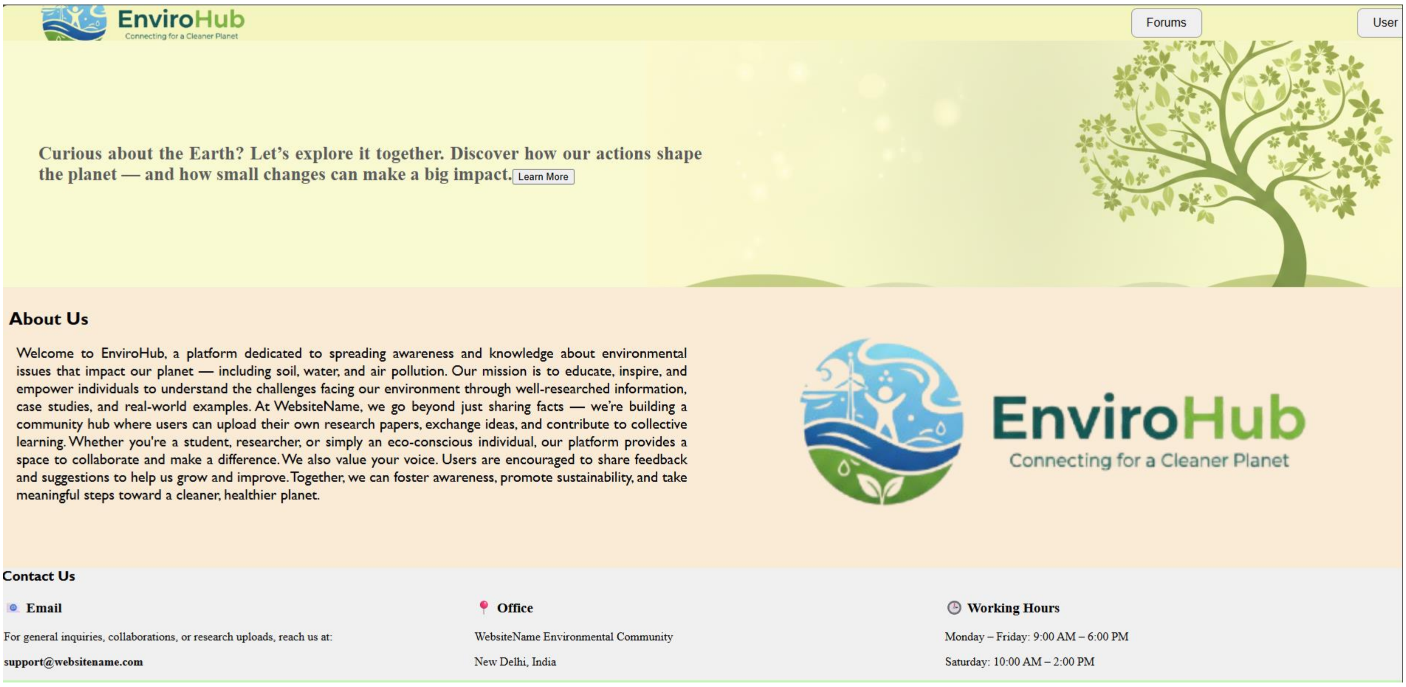
user

user@user.com

••••

2)Landing page

2.1)User



Curious about the Earth? Let's explore it together. Discover how our actions shape the planet — and how small changes can make a big impact.

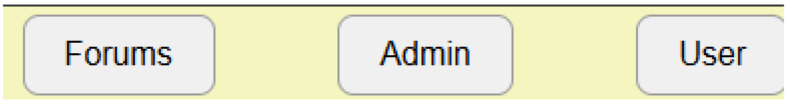
About Us

Welcome to EnviroHub, a platform dedicated to spreading awareness and knowledge about environmental issues that impact our planet — including soil, water, and air pollution. Our mission is to educate, inspire, and empower individuals to understand the challenges facing our environment through well-researched information, case studies, and real-world examples. At WebsiteName, we go beyond just sharing facts — we're building a community hub where users can upload their own research papers, exchange ideas, and contribute to collective learning. Whether you're a student, researcher, or simply an eco-conscious individual, our platform provides a space to collaborate and make a difference. We also value your voice. Users are encouraged to share feedback and suggestions to help us grow and improve. Together, we can foster awareness, promote sustainability, and take meaningful steps toward a cleaner, healthier planet.

Contact Us

Email	Office	Working Hours
For general inquiries, collaborations, or research uploads, reach us at:	WebsiteName Environmental Community	Monday – Friday: 9:00 AM – 6:00 PM
support@websitename.com	New Delhi, India	Saturday: 10:00 AM – 2:00 PM

2.2)Admin



3)Environment Awareness and Case Studies

3.1)Environment Pollution

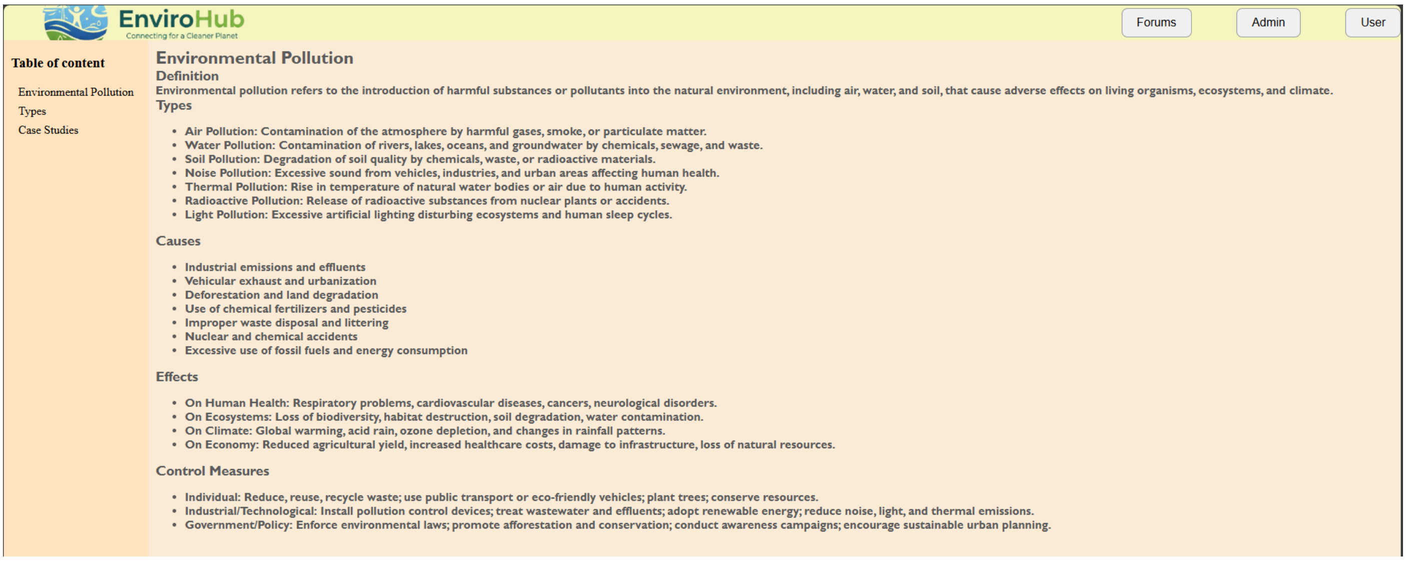


Table of content

- Environmental Pollution
- Types
- Case Studies

Environmental Pollution

Definition

Environmental pollution refers to the introduction of harmful substances or pollutants into the natural environment, including air, water, and soil, that cause adverse effects on living organisms, ecosystems, and climate.

Types

- Air Pollution: Contamination of the atmosphere by harmful gases, smoke, or particulate matter.
- Water Pollution: Contamination of rivers, lakes, oceans, and groundwater by chemicals, sewage, and waste.
- Soil Pollution: Degradation of soil quality by chemicals, waste, or radioactive materials.
- Noise Pollution: Excessive sound from vehicles, industries, and urban areas affecting human health.
- Thermal Pollution: Rise in temperature of natural water bodies or air due to human activity.
- Radioactive Pollution: Release of radioactive substances from nuclear plants or accidents.
- Light Pollution: Excessive artificial lighting disturbing ecosystems and human sleep cycles.

Causes

- Industrial emissions and effluents
- Vehicular exhaust and urbanization
- Deforestation and land degradation
- Use of chemical fertilizers and pesticides
- Improper waste disposal and littering
- Nuclear and chemical accidents
- Excessive use of fossil fuels and energy consumption

Effects

- On Human Health: Respiratory problems, cardiovascular diseases, cancers, neurological disorders.
- On Ecosystems: Loss of biodiversity, habitat destruction, soil degradation, water contamination.
- On Climate: Global warming, acid rain, ozone depletion, and changes in rainfall patterns.
- On Economy: Reduced agricultural yield, increased healthcare costs, damage to infrastructure, loss of natural resources.

Control Measures

- Individual: Reduce, reuse, recycle waste; use public transport or eco-friendly vehicles; plant trees; conserve resources.
- Industrial/Technological: Install pollution control devices; treat wastewater and effluents; adopt renewable energy; reduce noise, light, and thermal emissions.
- Government/Policy: Enforce environmental laws; promote afforestation and conservation; conduct awareness campaigns; encourage sustainable urban planning.

3.2)Soil,Water,Air

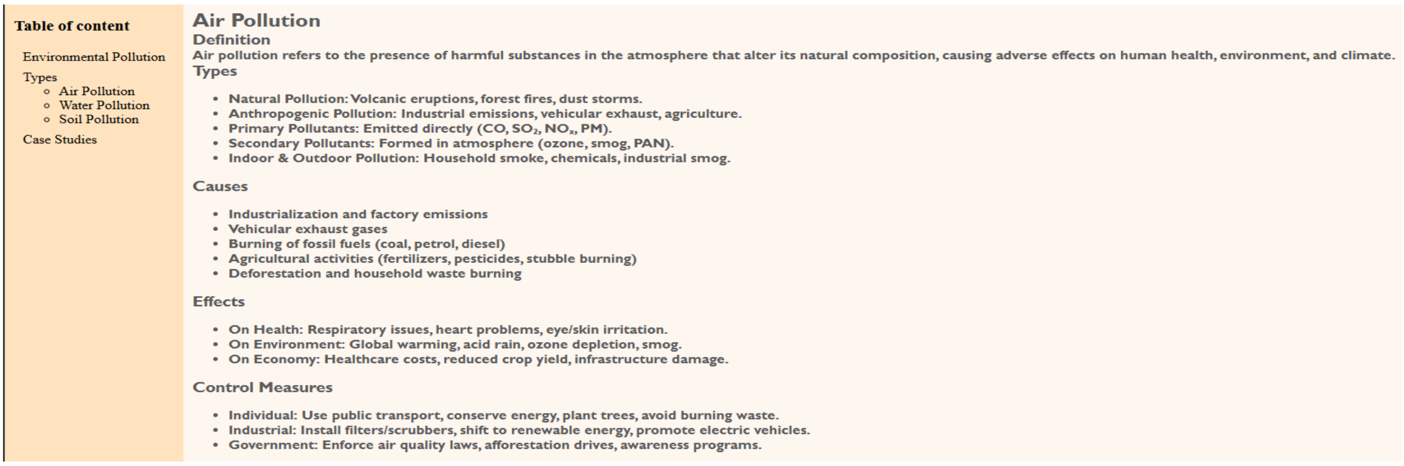


Table of content

- Environmental Pollution
- Types
  - Air Pollution
  - Water Pollution
  - Soil Pollution
- Case Studies

Air Pollution

Definition

Air pollution refers to the presence of harmful substances in the atmosphere that alter its natural composition, causing adverse effects on human health, environment, and climate.

Types

- Natural Pollution: Volcanic eruptions, forest fires, dust storms.
- Anthropogenic Pollution: Industrial emissions, vehicular exhaust, agriculture.
- Primary Pollutants: Emitted directly (CO, SO_2, NO_x, PM).
- Secondary Pollutants: Formed in atmosphere (ozone, smog, PAN).
- Indoor & Outdoor Pollution: Household smoke, chemicals, industrial smog.

Causes

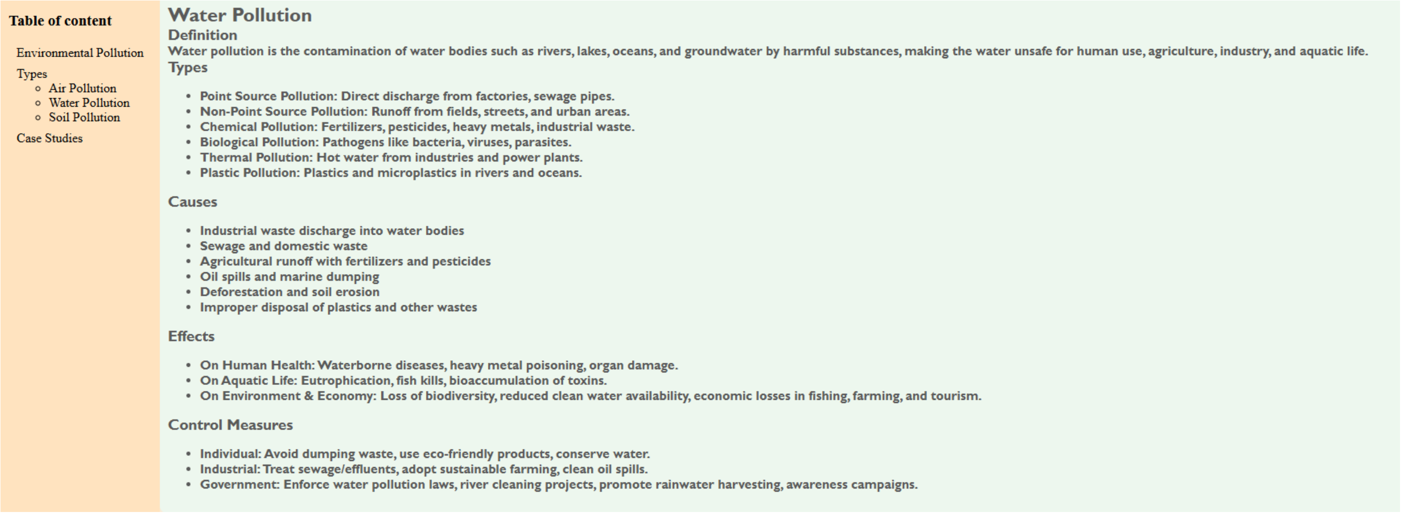
- Industrialization and factory emissions
- Vehicular exhaust gases
- Burning of fossil fuels (coal, petrol, diesel)
- Agricultural activities (fertilizers, pesticides, stubble burning)
- Deforestation and household waste burning

Effects

- On Health: Respiratory issues, heart problems, eye/skin irritation.
- On Environment: Global warming, acid rain, ozone depletion, smog.
- On Economy: Healthcare costs, reduced crop yield, infrastructure damage.

Control Measures

- Individual: Use public transport, conserve energy, plant trees, avoid burning waste.
- Industrial: Install filters/scrubbers, shift to renewable energy, promote electric vehicles.
- Government: Enforce air quality laws, afforestation drives, awareness programs.



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- Environmental Pollution
- Types
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  - Water Pollution
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Water Pollution

Definition

Water pollution is the contamination of water bodies such as rivers, lakes, oceans, and groundwater by harmful substances, making the water unsafe for human use, agriculture, industry, and aquatic life.

Types

- Point Source Pollution: Direct discharge from factories, sewage pipes.
- Non-Point Source Pollution: Runoff from fields, streets, and urban areas.
- Chemical Pollution: Fertilizers, pesticides, heavy metals, industrial waste.
- Biological Pollution: Pathogens like bacteria, viruses, parasites.
- Thermal Pollution: Hot water from industries and power plants.
- Plastic Pollution: Plastics and microplastics in rivers and oceans.

Causes

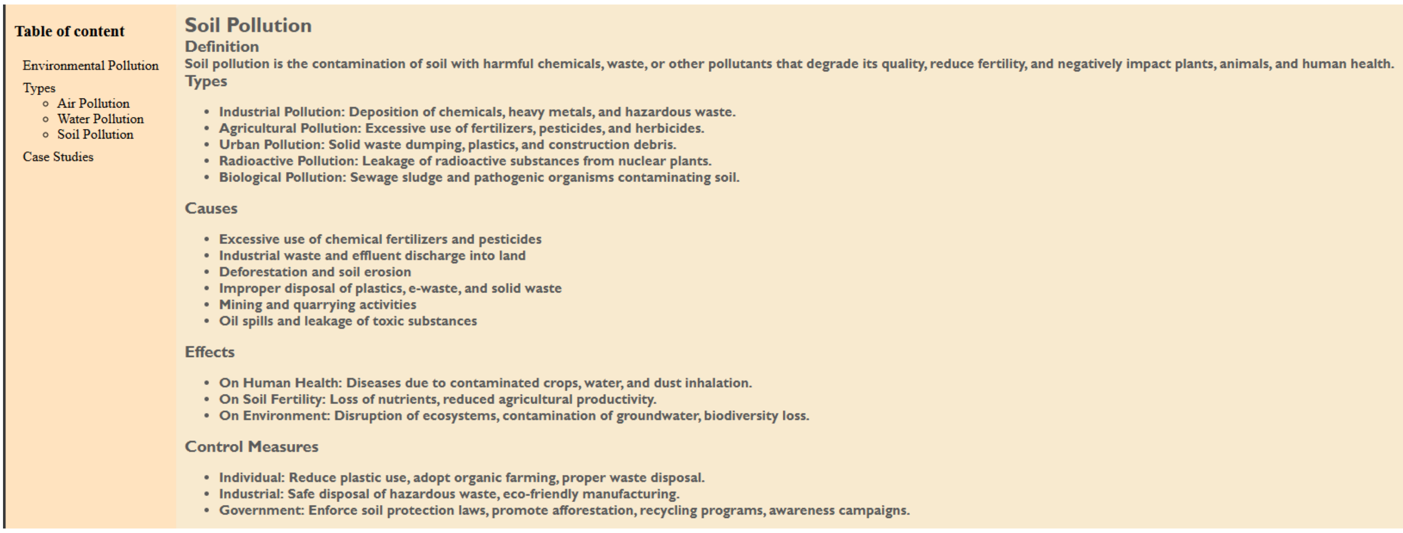
- Industrial waste discharge into water bodies
- Sewage and domestic waste
- Agricultural runoff with fertilizers and pesticides
- Oil spills and marine dumping
- Deforestation and soil erosion
- Improper disposal of plastics and other wastes

Effects

- On Human Health: Waterborne diseases, heavy metal poisoning, organ damage.
- On Aquatic Life: Eutrophication, fish kills, bioaccumulation of toxins.
- On Environment & Economy: Loss of biodiversity, reduced clean water availability, economic losses in fishing, farming, and tourism.

Control Measures

- Individual: Avoid dumping waste, use eco-friendly products, conserve water.
- Industrial: Treat sewage/effluents, adopt sustainable farming, clean oil spills.
- Government: Enforce water pollution laws, river cleaning projects, promote rainwater harvesting, awareness campaigns.



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Environmental Pollution

Types
- Air Pollution
- Water Pollution
- Soil Pollution

Case Studies

Soil Pollution

Definition

Soil pollution is the contamination of soil with harmful chemicals, waste, or other pollutants that degrade its quality, reduce fertility, and negatively impact plants, animals, and human health.

Types

- Industrial Pollution: Deposition of chemicals, heavy metals, and hazardous waste.
- Agricultural Pollution: Excessive use of fertilizers, pesticides, and herbicides.
- Urban Pollution: Solid waste dumping, plastics, and construction debris.
- Radioactive Pollution: Leakage of radioactive substances from nuclear plants.
- Biological Pollution: Sewage sludge and pathogenic organisms contaminating soil.

Causes

- Excessive use of chemical fertilizers and pesticides
- Industrial waste and effluent discharge into land
- Deforestation and soil erosion
- Improper disposal of plastics, e-waste, and solid waste
- Mining and quarrying activities
- Oil spills and leakage of toxic substances

Effects

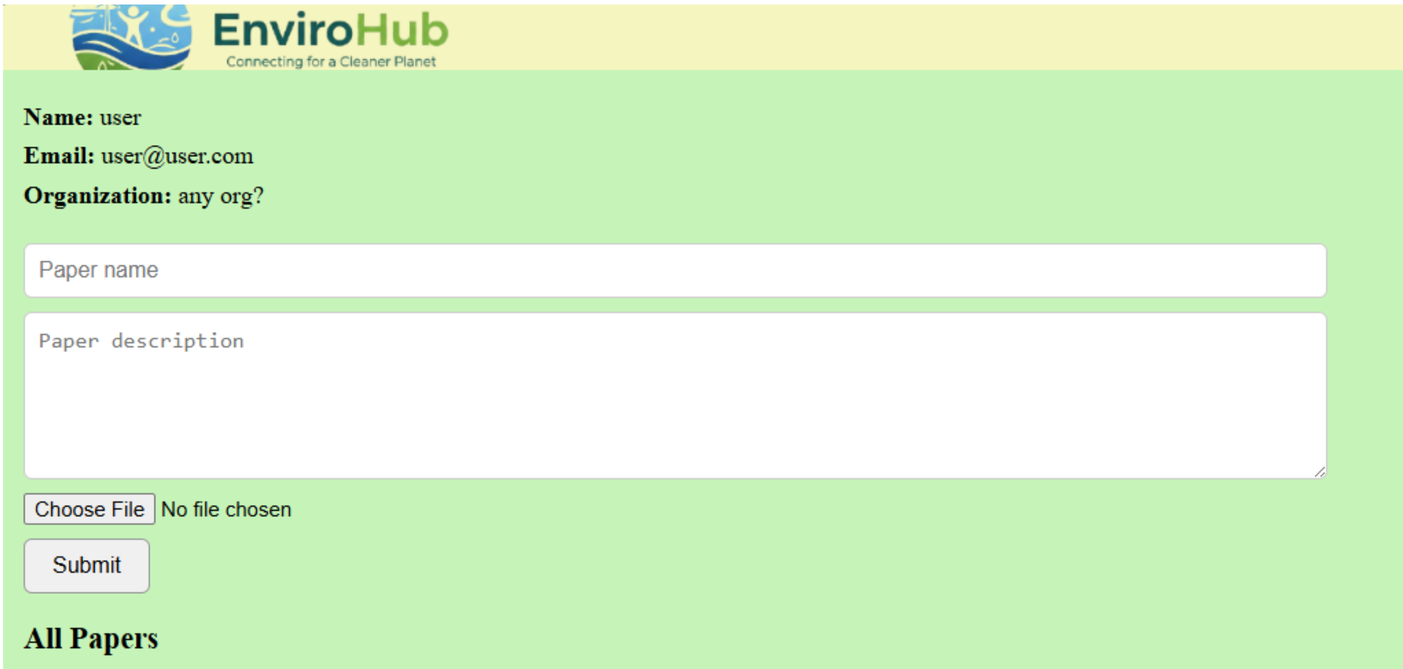
- On Human Health: Diseases due to contaminated crops, water, and dust inhalation.
- On Soil Fertility: Loss of nutrients, reduced agricultural productivity.
- On Environment: Disruption of ecosystems, contamination of groundwater, biodiversity loss.

Control Measures

- Individual: Reduce plastic use, adopt organic farming, proper waste disposal.
- Industrial: Safe disposal of hazardous waste, eco-friendly manufacturing.
- Government: Enforce soil protection laws, promote afforestation, recycling programs, awareness campaigns.

4)User Dashboard

4.1)Dashboard



Name: user

Email: user@user.com

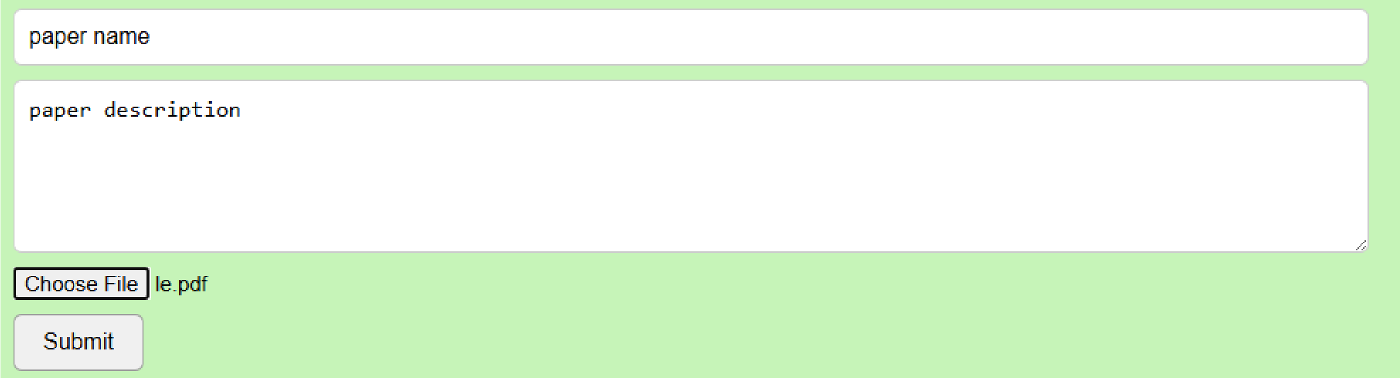
Organization: any org?

Paper name

Paper description

All Papers

4.2)Uploading Research paper



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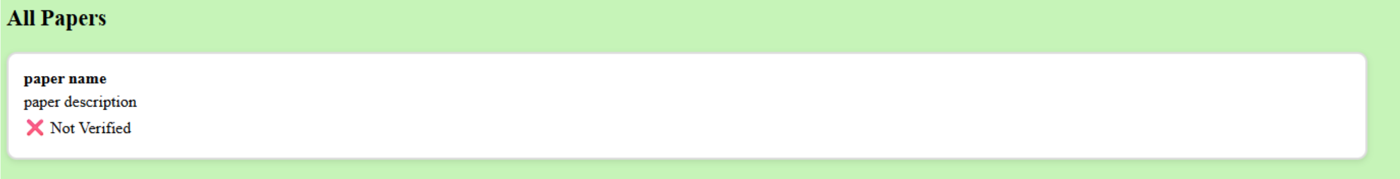

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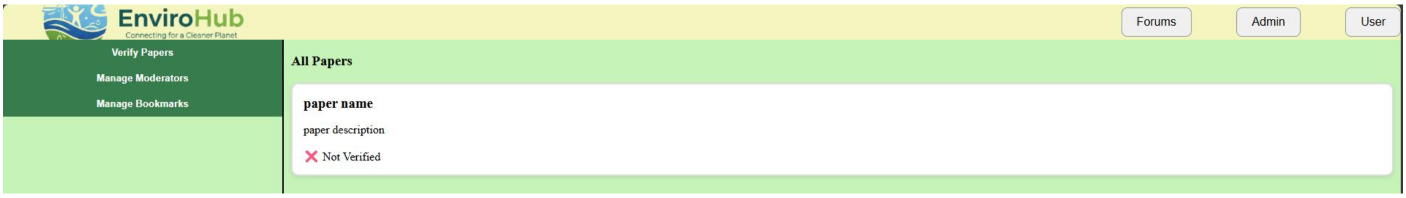
5)Admin dashboard

5.1)Dashboard



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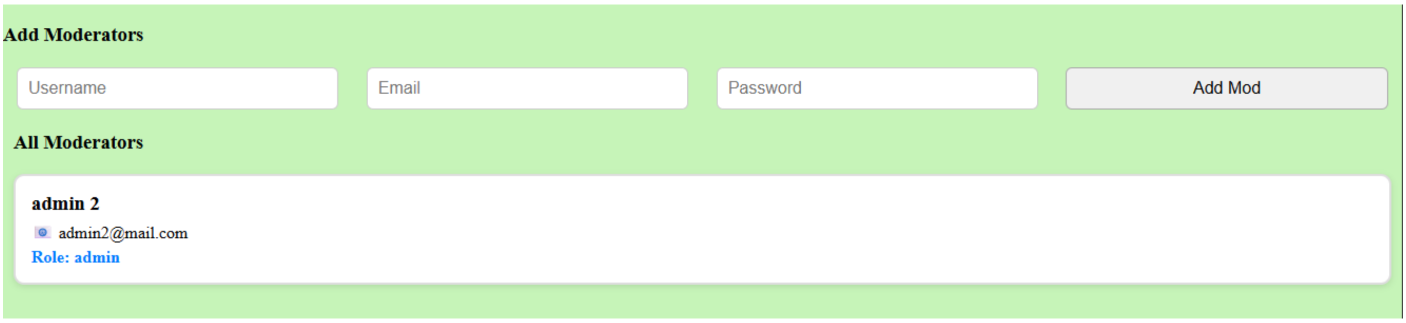
5.2)Add admins



Add Moderators

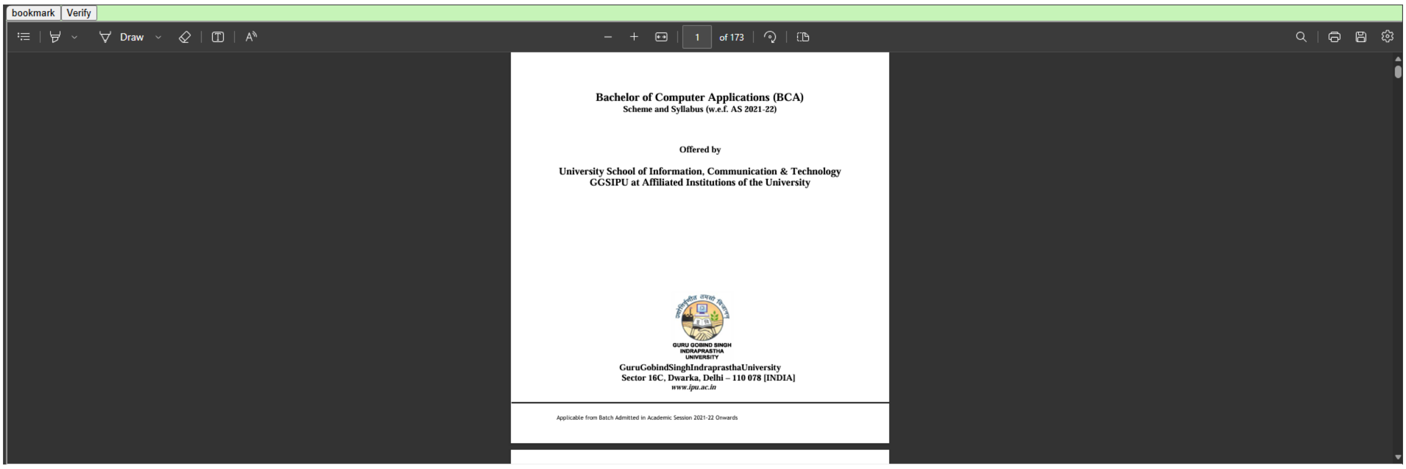
All Moderators

admin 2

admin2@mail.com

Role: admin

5.3)Bookmark and Verify paper



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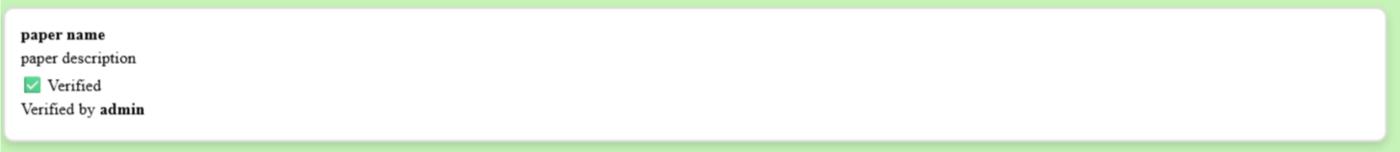

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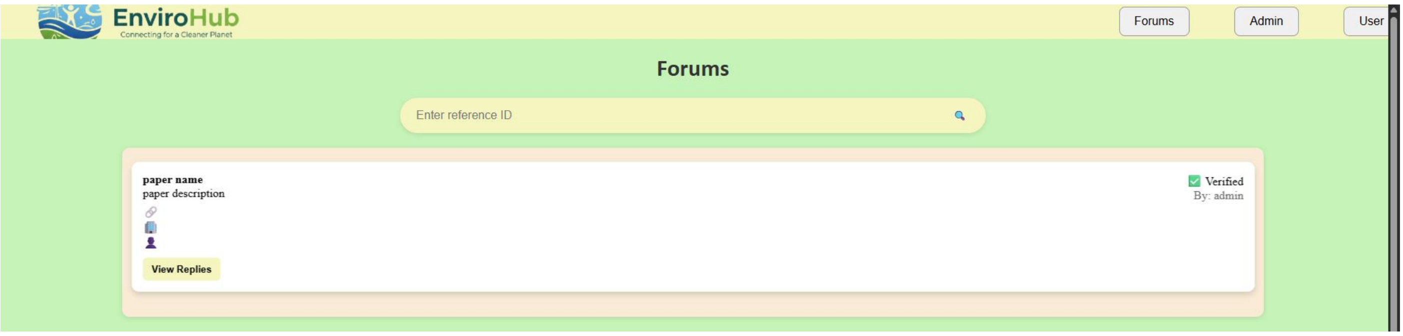
6)Forums

6.1)Forums Interface



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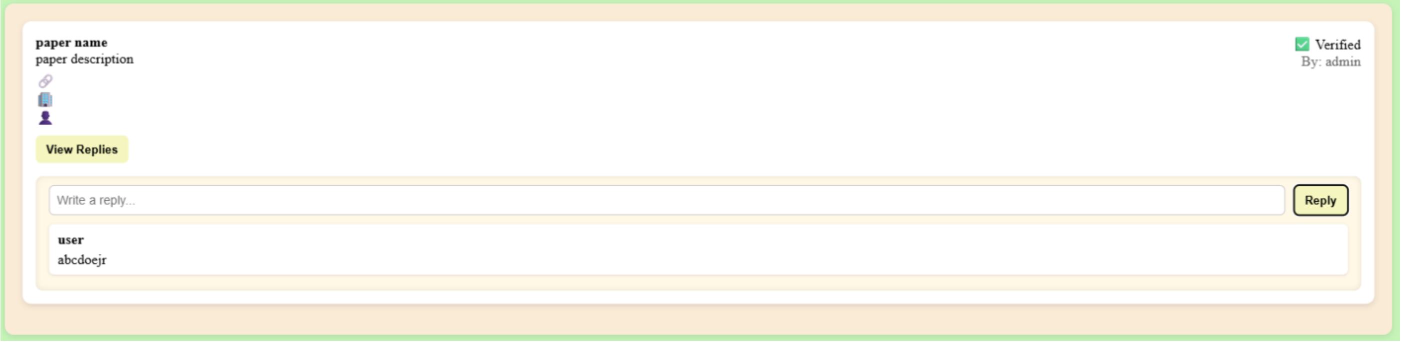
6.2)Replies



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Conclusion

- The Environmental Pollution Awareness & Research Hub is more than an academic project; it is a socially impactful digital platform. By combining awareness, research sharing, verification, and community engagement, the project addresses the major challenges of misinformation, lack of credibility, and fragmented environmental studies.
- The system empowers users to upload research, enables admins to verify content, and ensures that the general public has access to authentic, reliable information about pollution. Future enhancements such as AI-powered research screening, multilingual support, mobile applications, and integration with real-time environmental APIs can expand its reach and effectiveness.
- Thus, this project not only demonstrates technical expertise in MERN stack development but also contributes meaningfully to the global fight against environmental pollution.
- relief distribution transparently. In the future, enhancements such as AI-based disaster prediction, SMS/email alerts,
- multilingual support, and integration with national disaster databases will make this solution scalable to a state, national, or global level.
- Ultimately, the project demonstrates how technology and social responsibility can work together to create scalable, impactful, and sustainable disaster management solutions for society

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