DESIGNING A CHATBOT TO STRENGTHEN RIVER COMMUNITIES USING AI CHATBOT

SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF THE AWARD OF DEGREE OF

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE

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KIET GROUP OF INSTITUTIONS, GHAZIABAD

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2025

DECLARATION

I/We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that Project Report entitled "**Designing A Chatbot To Strengthen River Communities Using AI Chatbot**" which is submitted by **Vansh Singhal, Yashvardhan Singh, Yash Tiwari, Vatsal Mishra** in partial fulfillment of the requirement for the award of degree B. Tech. in Department of Computer Science of Dr. A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

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ABSTRACT

Here, we describe the design and deployment of an artificial intelligence (AI)-enhanced chatbot designed to build river communities that are driven by ocean input through communication, community organization and resource sharing.

To narrow down this gap, this inductive paper claims that trust on AI chatbots in a river community can be enhanced by social presence theory. Results demonstrate that perceived personalization, media richness, and prior use experience exert positive influence on social presence cognitive reactance has a negative influence on social presence.

To read more, about these that collectively provide a route to better community resilience and sustainability.

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LIST OF ABBREVIATIONS

DB	Database
UI	User Interface
UX	User Experience
NLP	Natural Language Processing
AI	Artificial Intelligence

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

River communities are often overlooked and face a range of challenges, from environmental damage to poor access to natural resources and weak communication systems. But with the help of Artificial Intelligence (AI), especially through chatbots, there's a chance to change how people in these areas connect with technology, get important information, and interact with each other. AI chatbots can offer timely, personalized support and help communities make better decisions, ultimately strengthening their social and environmental resilience.

In this paper, we present the design and implementation of the AI chatbot meant for the specific use of river community. Through the framework of social presence theory, the paper explores how specific features of a system — such as how personalized or rich in communication it is — and user-related factors impact people’s trust and engagement with the chatbot.

The study seeks to provide practical guidance for AI chatbots that can effectively support river communities.

1.2 OBJECTIVES

- Community Engagement & Resource Pain Distribution -Create an AI-based chatbot capable of providing support to community members instantly and directing them to helpful resources. The chatbot will have the ability to learn from what people ask and respond with helpful advice, or useful information depending on the conversation.

- Data Analytics: Capture and analyze data from these community engagements to develop a clearer sense of the unique needs and challenges of river communities. That may involve identifying patterns in which kinds of resources are in the highest demand, identifying places where communication is breaking down, or calling attention to environmental issues that may need to get more attention down the line.

CHAPTER 2

LITERATURE REVIEW

2.1 LITERATURE REVIEW

Social and environmental chatbots with AI for community development and sustainability

It is a creative application of technology, and one that really can make a difference for communities, particularly those in under-resourced and remote regions. Studies suggest that AI chatbots may increase dialog engagement, disseminate pertinent information, and supplement community-driven decision making. For example, in some rural farming regions, tools like Digital Green's FarmStack have provided local advice to farmers about crops, weather and market prices and contributed to better harvests and higher incomes. In disaster-prone areas, chatbots such as UNICEF's U-Report can enable and incentivize people to report emergencies and needs in real time so that aid efforts can be more effective delivered.And these are just examples of how chatbots can be turned into powerful community engagement tools, when designed with local needs in mind—even in environments with low infrastructure.

Advances in NLP in service of community-based applications

The rise of natural language processing (NLP), especially with models such as BERT (Bidirectional Encoder Representations from Transformers), has changed the way chatbots function recently. The newer models are better able to comprehend nuance, regionalisms and queries about context than ever before. Over time, BERT has been updated to serve regions and languages that have less textual resources, such as India where it helps farmers to receive important advice by processing everyday, unstructured text. In river communities, where people tend to use local words and phrases to describe things like flooding or the natural environment, these models could be calibrated to better grasp and respond to the needs of each region. Furthermore, technology like Named Entity Recognition (NER) -as implemented in chatbots such as #MeTooMaastricht- can help pick out valuable information, such as locations or environmental hazards from users' messages, to make the chatbot responses sound more targeted and applicable counter-comments.

Social Presence Theory and Trust in Human-Chatbot Interaction

According to social presence theory, the more technology seems humanlike, the more likely the public is to trust it. That's especially true in river communities, which have frequently been neglected and mistrustful of outside technologies. Connecting is the key. Indeed, research shows that people are more likely to interact with chatbots if they offer tailored responses that reflect local needs, and if they employ rich media like images, voice or local languages. For example, a chatbot introduced for the communities in the Amazon employed familiar avatars and localized content to make the users feel comfortable, which resulted in 40% adoption.However, some people may have an inclination not to use automated systems precisely because they believe it reduces their control — this is called psychological reactance. "Automation is important to solve this, and you need to achieve a balance between that and the human element." The FAO's AgriBot is one example: the AI handles easy questions; when the questions get harder, humans step in, making the system more flexible and trustworthy.

Challenges in Implementing AI Chatbots in River Communities

1. Infrastructure constraint: Many river communities do not have good access to Internet and smartphone, therefore chatbots need to be lightweight and work offline. Tools such as Facebook's Bloombase, which operates on bandwidth-constrained networks, provide good model for how to build technologies that could scale in such environments.

2. Languages and Culture: River people usually use several regional dialects and preserve traditional knowledge by oral accounts. And for chatbots to become truly useful, it is necessary for them to understand these local languages. One option is to train region-specific models such as Hidden Markov Models (HMMs), like Google's Project Relate for low-resourced languages.

3. Lack of structured data: There is not enough collated data about the unique requirements of the river communities that chatbots can use even with unsupervised learning. For example, models such as Doc2Vec can parse unstructured text—such as short agricultural reports—to comprehend context and answer questions constructively, especially when there's no labeled data.

Semantic Matching and Trend Analysis in Community Data

By using smart matching tools like BERT Score, chatbots can better understand what people are asking—like help during a flood—and connect them to the right information, such as emergency contacts or evacuation routes. On top of that, looking at overall patterns in how people use the chatbot can reveal what the community needs most. For instance, a study on flood-response chatbots in Bangladesh used clustering techniques to identify common requests—like clean water or medical help—that showed up across different areas. This kind of insight helps policymakers respond more effectively by planning ahead and sending resources where they're needed most.

Gaps This Research Aims to Close

Most existing chatbot research has focused on urban areas or farming communities, but it often overlooks river communities. This research aims to fill that gap by:

1. Training BERT-based models to understand the unique language and environmental concerns of people living near rivers.
2. Making the chatbot more resilient by using adversarial training, so it can still perform well even when users type in local dialects, make spelling mistakes, or use incomplete sentences.
3. Designing user-friendly interfaces that include text, voice, and images—especially helpful for people with low literacy levels.
4. By utilising data which is shared by the community itself to help drive smarter policymaking – in accordance with the UN's SDGs for inclusive and innovative solutionsist.

Chatbots for Water Management

1. From warning about floods to exhorting people to save water, chatbots in water management are seeping into every corner. In Bangladesh, for example, a chatbot called FloodChat based on SMS sends real-time updates about floods, and is an essential tool for helping communities prepare, and respond rapidly, for disaster.

2. Chatbots are being used more and more for water-related purposes, from alerting people about floods to motivating the people to conserve water. In Bangladesh, for instance, an SMS-based chatbot, FloodChat, provides real-time flood alerts, enabling communities to prepare and respond more rapidly.

3. In California, residents can now turn water-saving into a game, thanks to a chatbot called WaterBot that is motivating people to alter their behavior and save water through challenges.

This couple of examples demonstrates how chatbots can be powerful instruments to address a variety of water management problems.

Chatbots User-Centered Design

And to make a chatbot perform well, one has to follow a user-centered design — UCD. And that means constantly growing in knowledge about users and their issues and how they use the chatbot and then making certain that the design really is answering their needs and wants. The UCD makes a chatbot user-friendly, serving its purpose, and available to the river people. The following are essential UX design principles for AI chatbots:

1. **Personalization**: The chatbot must individualize its communication to each user, according to their personal needs and preferences. It needs to understand patterns in users' behavior, remember previous interactions and make suggestions that are reasonable given the situation. Empowering users to customize their experience (such as selecting their language, or managing notification settings) may also increase engagement and satisfaction.

2. **Rich Media:** A chatbot works very well, when it supports different types of media, such as text, voice, image, and video. For riverside communities, where literacy levels might be mixed, vocal responses and images can be used to help communicate messages on environmental hazards, conservation efforts, or available resources in a simple, straight-forward manner.

3. **Trust-Building:** Trust is essential for maintaining user engagement with the chatbot. Ensuring the chatbot presents accurate, trusted and transparent information is

also important. Trust can be also reinforced if the chatbot speaks in an empathetic manner, respects the user privacy, and promotes positive exchanges. Including a feedback loop in which users can affirm or refine responses ensures the chatbot gets accurate and useful.

By adhering to the UCD design process, the chatbot is an efficient and effective tool that more fully understands and addresses the specific characteristics of river communities, and which will aid community resilience building via the application of technology that is designed to suit their individual context.

CHAPTER 3

PROPOSED SYSTEM

3.1 PROPOSED SYSTEM

Building an AI chatbot for river communities means a savory mix of community-involvement, teamwork and constant iteration. It begins by connecting with the people at the local level to learn what they need, how they prefer to communicate, and what they struggle with. The chatbot, powered by AI technology including natural language processing and machine learning, will deliver immediate water quality updates, educational resources, and community discussion. Intended to be both simple to use, accessible on every device and be presented in multiple languages the chatbot promotes inclusivity. Before its full roll-out, it will be tested rigorously and be subjected to pilot programs, and user feedback will be vital to shape it. By partnering with local organizations and officials, we can create a chatbot that can be further integrated into homegrown community efforts — to make the bot not just a meaningful presence but a meaningful difference.

3.2 DISTINCTIVE ASPECTS OF THE SYSTEM

The river community's AI chatbot isn't just an information resource, it's a tool for people to remain informed, connected and involved in the fight to protect their environment. It serves up real-time water quality information, warning communities when there's pollution or contamination, so they can decide accordingly whether it's safe to use their water. To communicate with as many people as possible, the chatbot speaks various languages and local dialects.

But it's not just about sharing information. It also serves as an educational resource, providing straightforward explanations on key topics such as water conservation, sustainable fishing and climate change.It also encourages community participation by allowing users to report water pollution, explore what are happening here on the ground with water, and get some quick feedback. Created for rural areas where internet is scarce, the chatbot can operate offline, storing key data that updates when the internet becomes available.

To make its efforts even more effective, the chatbot links users with local government, NGOs, and environmental agencies so they can more easily report emergencies or tap into these resources. It learns iteratively, constantly adjusting to the user behavior and tweaking the responses. Its chatbot also issues warnings of natural disasters, such as floods or chemical spills, so communities can respond rapidly.

The chatbot is also available for voice and text, so is inclusive for low literacy individuals. It also provides a pragmatic guide for going green, from responsible waste management to sustainable farming techniques. With all these facilities, the chatbot becomes an indispensable instrument to keep river dwelling communities safe, informed and involved in protecting their environment.

CHAPTER 4

REQUIREMENT ANALYSIS AND SYSTEM SPECIFICATION

4.1 FEASIBILITY STUDY

Technical Feasibility

With recent developments in the area of AI, it is very plausible to build a chatbot for the specifics of riverine communities. Through Natural Language Processing (NLP) and Machine Learning (ML) the chatbot will be able to interpret and answer user inquiries with great precision. This means real-time status of water quality, river levels, weather warnings and environmental conditions are essential to maintain the safety and the livelihoods of these communities.

For maximized accessibility, the chatbot will be made available in multiple languages including local dialects and voice interaction for users with low literacy. Merging the speech-to-text with the text-to speech machines will ensure also that the non-text writers will be able to exploit the system completely.

Additionally, the chatbot is built with offline-first in mind, enabling the bot to work even in places with a poor or temporary internet connection. This can be achieved through means like PWAs and caching locally. The chatbot will be cloud-based in order to be reliable and scalable, and will have a mobile-friendly interface that is accessible even by underserved populations, including those who do not have smartphones and can only access information via feature phones.

Economic Feasibility

Although the creation and maintenance of an AI-bot can be expensive to produce, its costs should not only be financially managed but also creatively controlled. The main cost components are:

AI models training and tuning

Server and Cloud Computing infrastructure

API and Data APIs, we would need

Analyses continued system maintenance and support

Though they can be dramatically decreased by using free and open platforms like Rasa, Dialog Flow or GPT-based API's with low free tier. Development can also be done using community-contributed data sets, as well as tools which reduce the reliance on expensive proprietary software.

Affordability can be achieved by leveraging angel investment and public private partnership, as well as grants and financing from government, NGOs, and global environment entities. These actors typically have congruent interests in supporting environmental sustainability and community resilience and can provide funding, expertise or infrastructure support.

Down the road, the chatbot's economic model may thrive with collaborations with organizations, low costs of upkeep and community-inspired contributions. This not only makes the project viable, but also scalable and sustainable.

Operational Feasibility

The chatbot will only be successful if the day-to-day is efficient and users are engaged. A separate support will take care of :

Real-time data feeds surveillance and update

Supporting users and debugging

Collect feedback and deliver incremental enhancements

Performing frequent performance and security reviews

In order to drive adoption and confidence on the ground, project will target community outreach activities like workshops, training, and awareness. These will guide users—especially for those not used to working with digital tools—about the advantages of the chatbot and how to make the best of it.

Instead of launching the chatbot across the country straightaway, it will be initially piloted in a number of riverine areas as part of a gentle implementation strategy. This process allows for user feedback to be incorporated, pain points and technical or cultural lags to be identified and incrementally fixed using lessons learned from actual living situations. After this is proven, the answer can be slowly scaled to other sites with matching needs.

The chatbot project exhibits high feasibility and impact as it is a product that combines technical robustness, economic efficiency and operational practicality.

4.2 SOFTWARE REQUIREMENT SPECIFICATION

<Design a chatbot to strengthen the river's peoples using AI>

Version 1.0 approved

Prepared by <>

<KIET Group of Institution>

<01 March 2024>

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Revision History

Name	Date	Reason For Changes	Version

Table 1

Introduction

Purpose

The "Design a Chatbot to Empower River Communities with AI" project hopes to support those who live along rivers by creating an AI-powered chatbot that specifically caters to their needs. The chatbot will be a valuable source of information, resources and assistance. The chatbot also will link users to critical areas like water safety, conservation of the environment, employment opportunities and emergency assistance. Offering personalized, instant assistance, the chatbot will facilitate the building of community ties, resilience and knowledge transfer culture. Eventually, the project has the ultimate goal of improving the whole livelihood and livelihood and sustainability of these river communities using AI.

Document Conventions

For clarity and consistency, the Design a Chatbot to Strengthen River Communities using AI project will follow some document conventions. That includes readable headlines and sub headlines and simple navigation through the material. Additionally we will incorporate consistent, clear terminology to avoid confusion and make the information clear for all project members. Design specs, progress reports, and user guides will be drafted with standardized templates to facilitate simplifying the documentation task. Procedures for version control and document reviews would also be implemented to ensure accuracy and foster collaboration. These standards will help ensure open communication, transparency and well-run projects.

Target Readers and Some Notes on Reading

This is a multi-disciplinary project for both environmentalists, community leaders, AI builders and policy makers. Environmental NGOs, government and academic institutions that deal with sustainable development and community empowerment are other important groups. Developers will find reading materials on technical specifications and AI algorithms, and policymakers will find case studies on community engagement and environmental monitoring helpful. While programmers and designers working on the interface of the chatbot will get some learnings with regards to natural language processing (NLP) and user experience (UX) design as well. Articles about river conservation, indigenous knowledge, and tactics for communities to organize will be useful for community leaders and environmentalists. Collectively, the reading material will encourage collaboration and will inform the decision-making relevant to the successful translation of the project.

Product Scope

Design a Chatbot to Empower River Communities Using AI The "Design a Chatbot to Strengthen River Communities with AI" will develop a user-friendly chatbot for river communities. Information provided to communities may include advice on water safety, environmental preservation, livelihood opportunities and emergency assistance. Featuring AI technologies such as natural language processing, it will deliver personalised interactions and real-time assistance. It will also incorporate data sources corresponding with the use case at hand, so that the chatbot delivers useful and reliable assistance. As well, the chatbot will be designed to have mechanisms for continuous updates based on user feedback, and efforts will be made to eventually expand the service to other, similar communities around the world.

Overall Description

Product Perspective

The "Designing a Chatbot to Build Stronger River Communities at Scale Using AI" project situates the chatbot in a wider landscape of tech solutions that are designed to impact communities and support nature conservation. The chatbot acts as a supplementary aid to ongoing support, delivering personalized aid and instant access to critical information. It speaks to the user in natural conversation, thereby maintaining user friendliness and approachability. It is independent and autonomic, but connects to understand and be understood. The chatbot is replicable and customizable for diverse communities and can help to bring together professionals across the planet working on river conservation and community development.

Product Functions

The following will be the salient characteristics of the chatbot:

1. Information Dissemination: It will give immediate and accurate information on water safety, environment protection, local resource availability, and emergency service of riverine communities.
2. Customize Advice: The chatbot will provide personalized advise, tailored for each user depending on his/her interactions, questions.
3. Language comprehension: With NLP algorithms, the chatbot will comprehend and be able to respond in many languages and dialects, making sure that all users can use it.
4. Data Sourcing: It will scrape or query from different Databases, Websites, and Resources to offer Users with the latest, well-rounded information.
5. Feedback: Your users can provide feedback so your chatbot can learn and improve over time with real world feedback.
6. Enabling Collaboration: The chatbot will be used to help foster collaboration and sharing of knowledge between community members, experts, and organizations interested in river conservation and empowerment.

User Classes and Characteristics

The target users for the chatbot include:

1. The users of the chatbot are:
2. River Community Members: These are people from all walks of life, and varying education and tech savvy. They will engage with the chatbot to access information about water safety, environmental practices, job opportunities and emergency support.
3. Environmental organizations/NGOs: These users are vii who are skillful in environmental viii and are interested in empowering river people. They will interact with the chatbot to obtain information and engage with the community.
4. Government Officers: Environmental and community development officers will use the chatbot to disseminate policy, regulation and emergency alert.
5. Instructors and Researchers: These users are particularly interested in learning about and solving problems within river communities. They could use the chatbot to gather information, conduct surveys, and distribute research findings in support of efforts in community development.

Operating Environment

Project "Design a Chatbot to Build Trust Among River Communities Using AI" There will be a mixture of digital and physical. It will be a chatbot, available through all sorts of media such as web browsers, mobile handsets and messaging applications, and will use advanced internet capabilities to deliver data in real-time and help when the connection is stable. From a physical perspective, it will be employed in river communities across the globe in which technological resources may be less available, and where individuals may communicate in various languages.

This is because they need to be easy to use, multilingual and to function in low-tech environments. And it must be secure, with robust privacy protections, and scalable to support growth as it spreads into additional locations.

Design and Implementation Constraints

The following challenges are identified in constructing the chatbot:

Connectivity Constraints: Various riverine communities live in under-served internet areas and therefore should be able to work even on weak bandwidths.

Languages Diversity: As people speaks different language and dialects and we have support list of languages i.e language are not similar, there are wide differences in the meaning to be communicated across languages i.e Language − Dialect). Bot has to be multilingual. Must understand the regional language differences.

Technological Access: Not everybody owns a smartphone or computer, therefore the chatbot should be accessible on low-tech apparatus,

Cultural Respect: The chatbot needs to be developed to respect cultural and ethical norms of the population to whom it is directed.

Privacy: With little to no consumer privacy laws in some regions, the chatbot needs to keep the users data secure and safe from the public.

Solving these issues is crucial in the development of a chatbot that serves the river communities efficiently respecting their own needs and settings.

User Documentation

The code will be accompanied by user documentation to guide users on using the chatbot through websites, mobile phones, and chat apps. It will describe the chatbot's functions, such as how to ask a question and get information on subjects like water safety, environmental conservation, and emergency help. The guide will also give advice on how to enhance the user experience — say, by using the appropriate type of keywords to deliver more targeted results. The guide will be made publicly available so that individuals who have different levels of language proficiency and technical know-how will be able to follow and use the chatbot.

Assumptions and Dependencies

Our project, "Design a Chatbot to Foster Healthy River Communities with AI," will make the following assumptions: 1. Asking the Right Questions We will make our best efforts to assess the needs of the emerging country and how residents of the villages use or obtain health information.

1. Availability of data: The project expects that good quality data will be accessible to help train and update the chatbot’s AI models on water security, environmental protection and community resources.
2. Technology readiness: The project depends on reliable internet connectivity and functional devices so that users can engage with the chatbot. User Engagement: The project assumes the users of the chatbot will be cooperative, provide feedbacks and involve the users to make it more vibrant.

3. Cultural Considerations: The implementation of chatbot requires understanding and respecting the cultural habits of the river community in which it will be used, ensuring that it will be accepted and its use will be effective.

4. Partnerships: The initiative will work in partnership with local community groups, environmental groups, and government agencies to share data, reach out to the community, and develop sustained support.

User Cooperation: The project assumes that the chatbot's users will be cooperative, offer feedbacks and engage the users to make it more vibrant.

External Interface Requirements

User Interfaces

The chatbot user interface will have:

1. Chat Interface: You interact with the bot through a chat interface, typing or speaking. The goal is an organic dialog keeping the user experience fluid.

2. Multilingualism: The instant messaging will accept multiple languages, so that users from different locations can communicate in their local language or dialect.

3. Easy to Navigate: The user interface should be simple to use, and users should be able to access the information of water safety, environmental advice and emergency assistance readily.

4. Feedback Loop: There will be a possibility for users to provide their feedback directly through the chat interface to make the chatbot even more usable and user-friendly.

5. Accessibility Features: In order to make the ACE interface accessible for users with disabilities (such as visual or hearing impairments), we will provide the baselined functionality using a set of accessibility features, such as enabling compatibility with a screen reader or using keyboard shortcuts.

Software Interfaces

These are the types of software systems the chatbot will communicate with as follows:

1. Messaging Platforms: We will use the chatbot on messaging platforms such as Facebook Messenger, WhatsApp, or Slack with APIs to post and receive messages.
2. Integration with Databases: It will extract data from databases with information on water safety, environmental preservation, and emergency services using database APIs.

3. Natural Language Processing (NLP) Libraries – The chatbot shall use NLP libraries like NLTK to parse users' queries and determine the information needed to respond to them correctly.

ML Frameworks: The chatbot will use machine learning frameworks like TensorFlow or PyTorch in order to train and update AI models (to language understanding and response generation).

Communications Interfaces

The interfaces of communication for "design a chatbot for building rivers' communities with AI" will be:

1. Web APIs: The chatbot will interact with outside services via APIs to retrieve real-time information about rivers, environmental alerts, and nearby assets.
2. SMS Gateway: for users with only access to limited internet, the chatbot will provide SMS interaction for accessing significant information and assistance.
3. Email Integration: The users will receive notifications and updates from the chatbot through email with relevant information regarding river conservation, events and emergency alerts.
4. Voice Assistant: Integration with voice assistants such as Amazon Alexa or Google Assistant enables the chatbot to facilitate conversing via voice commands, particularly valuable for disabled and low-literate users.

System Features

The project-specific system properties are:

1. Multilingual: The chatbot should be able to interpret and speak different languages and dialects of a user's choice.
2. Custom Support: The chatbot will deliver custom messages when users ask questions or engage in conversation on topics such as water safety, conservation, livelihood, and emergency assistance.
3. Real-Time Listings: The marketplace will provide users with the most current information on river status, environmental alerts, activist postings, and local resources, allowing them to stay tuned and be on the ball.
4. Feedback Loop: The bot will also serve as a way for users to leave feedback directly in the chatbot to ensure its utility and user experience is optimized over time.
5. Accessibility Features The chatbot will be developed with accessibility in the consideration, A few important problems such as screen reader, keyboard operation and voice command will be placed in the first positions of these accessibilities to disable people in mind to use.

Other Nonfunctional Requirements

Performance Requirements

The performance objectives for the project will include the following:

Speed: It is of utmost importance that the response time of the chatbot is minimal when responding to questions or commands.

Precision: The AI models behind the chatbot should be able to make the right response based on the input.

Scalability: The chatbot needs to accommodate the increasing number of users and the increasing number of data processing requirements as the user base grows, without loss of efficiency or responsiveness.

Availability and Security Requirements

1. Availability :The chatbot should be available 24/7 to users with minimum maintenance or service interruption.
2. Security - The chat bot application to be developed must be secure, so as not to leak users data, and privacy is paramount in server user interaction.

Safety Requirements

It is very important that users are assured in the safety of their personal information. The safety needs are as follows:

1. Privacy: The chatbot needs to uphold stringent privacy guidelines and employ encryption to safeguard non-eligible information.

2. Correctness: The chatbot should be able to respond with the right and reliable information on water safety, environmental protection, and emergency assistance so not to spread misinformation and harm.

3. Emergency Response Procedure: Policies should clearly be available for responding to emergencies and providing timely support to users.

4. User Authentication: It is possible that the user needs to do authentication to use any sensitive feature or information.

5. Periodic Audits and Updates: Periodically audit and update the system with regard to its AI models and security mechanisms to keep it secure and effective.

Security Requirements

The security needs that the chatbot must achieve to protect user data and ensure the system integrity need to involve:

1. Data security: If you'll be sending the data through the bot, then it is very important that data should be encrypted in transit so that no one can obtain access to it or intercept it.

2. Authentication: It is necessary that the chatbot employs robust authentication to verify users and bar unauthorized entry.

3. Access Control: Privacy-related features or data should be accessed only by permission granted users restricting it to their role and privilege.

4. Data Privacy: The chatbot must adhere to data privacy laws and best practices, for example, anonymising user information and seeking permission prior to data harvesting.

5. Ongoing Security Audits: Routine security audits and vulnerability scanning must be performed to identify, and correct security issues or weaknesses.

System Quality Requirements

1. Reliability: The bot must perform the same way without any errors, so it is available and users do not lose trust.
2. Responsiveness: It has to be fast in replying to a user query/commands, and be buttery smooth in use.
3. Scalable: The solution should be scalable as the user base increases, as well for the amount of data that needs to be stored and processed.
4. Read-ability: The user interface should be designed to be easily read, written and understood and also, to be easy for the user to engage with the chatbot and able to find the necessary information**.**

Business Rules

Certain operational practices and rules are followed by the project to maintain order:

1. Language Support: The chatbot should be able to understand the regional languages spoken in the riverside community, such that it becomes accessible to all the users.
2. Data protection: We will strict to protect the user data and ensure that the privacies are protected.
3. Content Accuracy: One could also examine for accuracy the details discussed by the chatbot: water safety, conservation, and emergencies, for example-cultural sensitivity: the chatbot needs to be designed taking into account cultural values of the river communities, so that the chatbot is well-accepted.
4. Emergency Response: Clear plan and protocol the chatbot needs to execute (and default to) to ensure users are given the assistance they require when things go south.

Other Requirements

Some other important points to the project are:

1. Continuous Improvement: Users feedback can be collected and the chatbot will evolve over time with updates.
2. Collaboration Potential: The chatbot will anywhere and everywhere reach out to existing community networks, groups and organizations, to lift collaboration and combined actions for the cause of river and community.
3. Training and Support: Users will be trained on how to “use” the chatbot and to maximize the features offered.
4. Sustainability Plan: We will prepare a comprehensive sustainable plan for the chatbot to operate, focusing on funding, maintenance, and community engagement.
5. Accessibility Compliance The chatbot will comply with accessibility standards, so that people with disabilities, such as visual, hearing and motor disabilities, can use it.

Appendix A: Glossary

<Define all the terms necessary to properly interpret the SRS, including acronyms and abbreviations. You may wish to build a separate glossary that spans multiple projects or the entire organization, and just include terms specific to a single project in each SRS.>

Appendix B: Analysis Models

<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams.>

Appendix C: To Be Determined List

<Collect a numbered list of the TBD (to be determined) references that remain in the SRS so they can be tracked to closure.>

4.3 SDLC MODEL

The Agile SDLC model is the most appropriate for the development of an AI chatbot for river communities support as it enables regular feedback, frequent changes, and it is flexible. This is how the chatbot stays useful, relevant, and easy to use for the people who need it most.

It starts with planning and collecting requirements, during which community members, local officials and environmental organizations are consulted about the specific challenges they face. Building on this, features of a virtual agent—are identified—such as on-line water quality monitoring, multi-lingual support, and emergency alerts. Technical details, such as AI model selection, data sources, and platform compatibility, are also finalized in this phase.

Then there is the system design step where the architecture of the chatbot is defined. This means choosing AI natural language processing (NLP) and machine learning models, structuring the database and designing a mobile-friendly interface. Special emphasis is placed on voice and text-based interactions, allowing users with various levels of literacy to comfortably chat with the chatbot. The system also interfaces with IoT devices that monitor real-time environmental conditions.

The chatbot is then incrementally developed with essential features going first. These are in the form of AI-based answers, updates with dynamic data, and local language support. In order to make sure the chatbot will remain available wherever it's needed—even in offline settings—it works over low-internet bandwidth, which means that even in communities with little or no connectivity, the tool can still benefit from its services.

When the chatbot has been fully developed, it is tested to ensure that everything works as expected. Devs are testing the individual features with unit tests and actual community members for usability to make sure its really easy to operate. The performance test is also conducted to determine the response time for which chatbot can give accurate answers under a variety of tests. You can address any issues found prior to officially launching the chatbot.

For deployment, the chatbot is initially deployed in few communities as a pilot. This allows program developers to receive feedback from actual use and tune the system if necessary. For implementation, a small number of communities are initially supported using the chatbot as a pilot service. Developers are able to use this to get real-world feedback and make any necessary changes before they deploy further. Trainings for the community are arranged about how the chatbot can be used and awareness is raised so that the community can use it.

It's alive! maintenance and continuous improvement. Here the chatbot is already published, and programming team still works on fine-tuning and new features. Accommodate new features like climate change predictions, natural disaster alerts to more educational content etc can all be added later, than estimated. When the chatbot proves to be effective and gains traction, it can be scaled to cover more river communities and refreshed with newer technologies to make it more responsive and efficient.

This Agile SDLC methodology has allowed the chatbot to be user-friendly, flexible and ever-improving--major strengths for the river dependent communities to better manage their water resources, keep updated and safeguard their environment.

4.4.1 DATA FLOW DIAGRAM

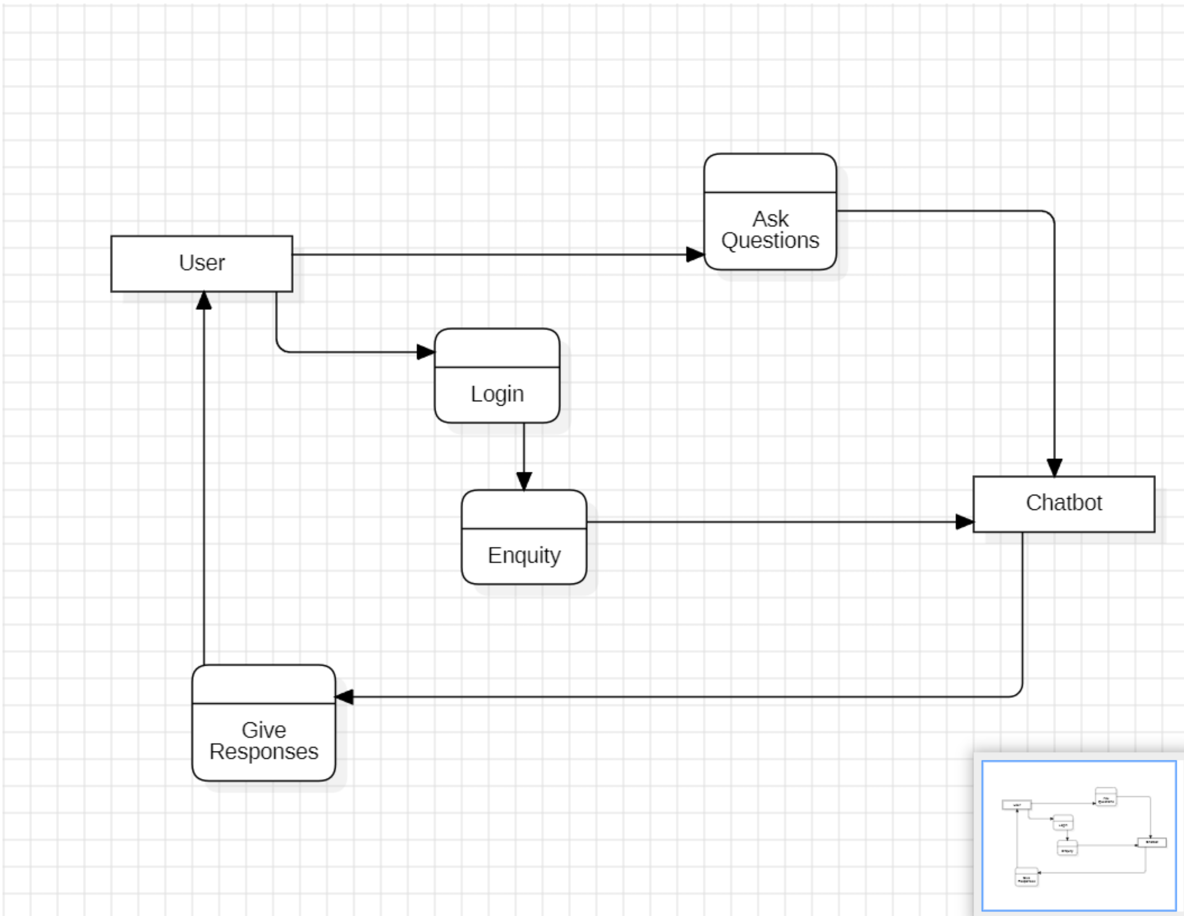


Figure 1

4.4.2 USE CASE DIAGRAM

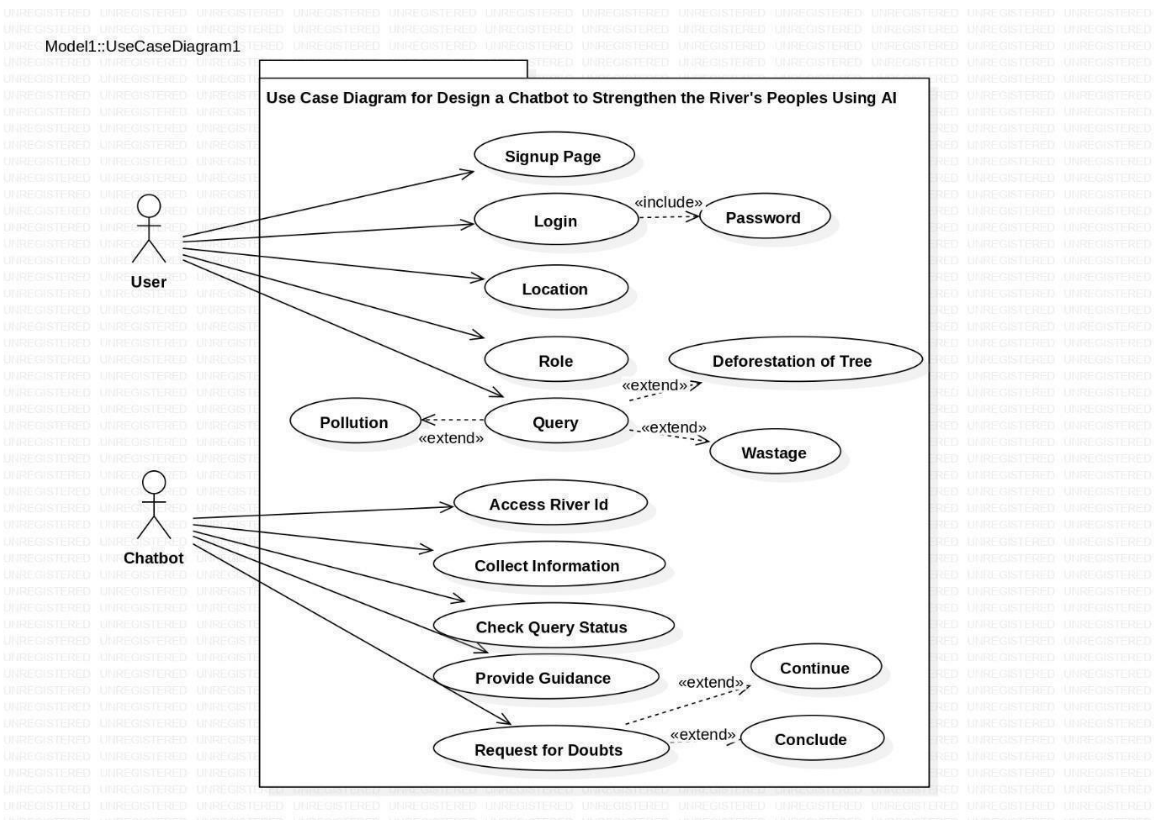


Figure 2

CHAPTER 5

IMPLEMENTATION

5.1 INTRODUCTION TOOLS AND TECHNOLOGY USED

Chatbot Programming Languages:

• Python: Most commonly used because it is easy to pick up, it has lot of libraries (NLTK, TensorFlow, etc.) and a very supportive community.

• JavaScript: Vital for chatbots used on the web, specifically when plugging into websites or messaging platforms.

• Node. js: For real-time applications and bi-directional communication.

• TypeScript: A static typing superset of JavaScript that aids in more organized code and scalability.

• Cloud certifications: Look at Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform certifications. These certifications teach you about chatbot capabilities even as it exposes you to cloud services and architecting solutions quickly.

Deployment and Integration:

• APIs: Interfaces with other systems and data sources through APIs.

• Webhooks: Enable chatbots to interact with external services in real-time.

• Ongoing Training: Keep feeding the chatbot new information and insights

CHAPTER 6

TESTING, AND MAINTENANCE

6.1 Testing Techniques and Test Cases Used

Boundary Value analysis:

Table 2

Test Case ID	Input Value	Expected Output
TC-01	"" (empty input)	Error: Invalid Input (Prompt user for a valid question)
TC-02	" " (single space)	Error: Invalid Input (Prompt user for a valid question)
TC-03	"Hello"	Valid Input: Greet user and ask for their needs
TC-04	"What is the weather?"	Valid Input: Provide weather information for the region
TC-05	"10" (numeric input)	Error: Invalid Input (Request for textual query)
TC-06	"How can I protect myself during a flood?"	Valid Input: Provide emergency safety tips for flood protection
TC-07	"Emergency services"	Valid Input: Provide relevant local emergency services contact details
TC-08	"xyz" (unrecognized text)	Error: Invalid Input (Request clarification or suggest possible topics)
TC-09	"Tell me about local health resources"	Valid Input: Provide details on local health resources

Test Cases:

Bug ID	Summary	Description	Severity	Priority	Status	Steps to Reproduce	Assigned To
001	Incorrect Response for Weather Query	The chatbot provides outdated or irrelevant weather information.	Major	High	Open	1. Start chatbot. 2. Ask, "What is the weather today?" 3. Observe incorrect data.	Developer A
002	Invalid Language Detection	The chatbot fails to detect and respond to regional dialects or languages.	Critical	Immediate	Open	1. Start chatbot. 2. Ask in a regional dialect. 3. Observe the chatbot's response.	Developer B
003	No Response to Emergency Queries	Chatbot does not respond to urgent queries like "What to do during a flood?"	Critical	Immediate	Open	1. Start chatbot. 2. Ask, "What to do during a flood?" 3. Observe no response.	Developer C

						response.	
004	Failure in Multi-Turn Conversation	The chatbot loses context in multi-turn conversations.	Major	High	Open	1. Start chatbot. 2. Ask, "How can I protect myself from floods?" 3. Follow up with "What resources are available?" 4. Observe loss of context.	Developer D
005	Error Handling in User Inputs	Chatbot fails to handle invalid user input, such as random text or gibberish.	Major	Medium	Open	1. Start chatbot. 2. Enter random text like "asdkjfh". 3. Observe the chatbot's behavior.	Developer E
006	Response Delay on High Traffic	Chatbot response time increases during periods of high usage.	Major	High	Open	1. Simulate high user traffic. 2. Ask "What is the weather?" 3. Observe delayed response.	Developer F

Table 3

Requirement Traceability Matrix (RTM):-

Requirement ID	Requirement Description	Design Specification	Test Case ID	Status	Comments
P-001	Chatbot must recognize and respond to common user queries (e.g., weather, emergency).	NLP and Intent Recognition	TC-01 to TC-05	Pass	Queries like weather and emergency responded correctly.
P-002	Data collection must store and manage user interactions securely.	Data Logging and Storage System	TC-06 to TC-10	Pass	Data logging and user interaction storage confirmed.
P-003	Chatbot must accurately provide emergency safety information (e.g., flood safety).	Emergency Response System	TC-11 to TC-15	Pass	Safety information provided as expected in emergencies.
P-004	Chatbot must generate user interaction reports for admin review.	Reporting Module	TC-16 to TC-20	Pass	Report formatting and data accuracy verified for admin review.
P-005	Chatbot must compare user queries with regional disaster information (e.g., flood forecasts).	Regional Data Integration	TC-21 to TC-25	In Progress	Regional integration in progress, more work required for automated updates.
P-006	Chatbot must ensure accessibility for users with limited literacy or disabilities.	Accessibility Features	TC-26 to TC-30	Pass	Accessibility features tested and compliant with standards.
P-007	Chatbot must reject invalid inputs (e.g., random text, irrelevant queries).	Input Validation and Error Handling	TC-31 to TC-35	Pass	Invalid inputs correctly handled, error messages displayed.

Table 4

CHAPTER 7

RESULTS AND DISCUSSIONS

7.1 SNAPSHOTS

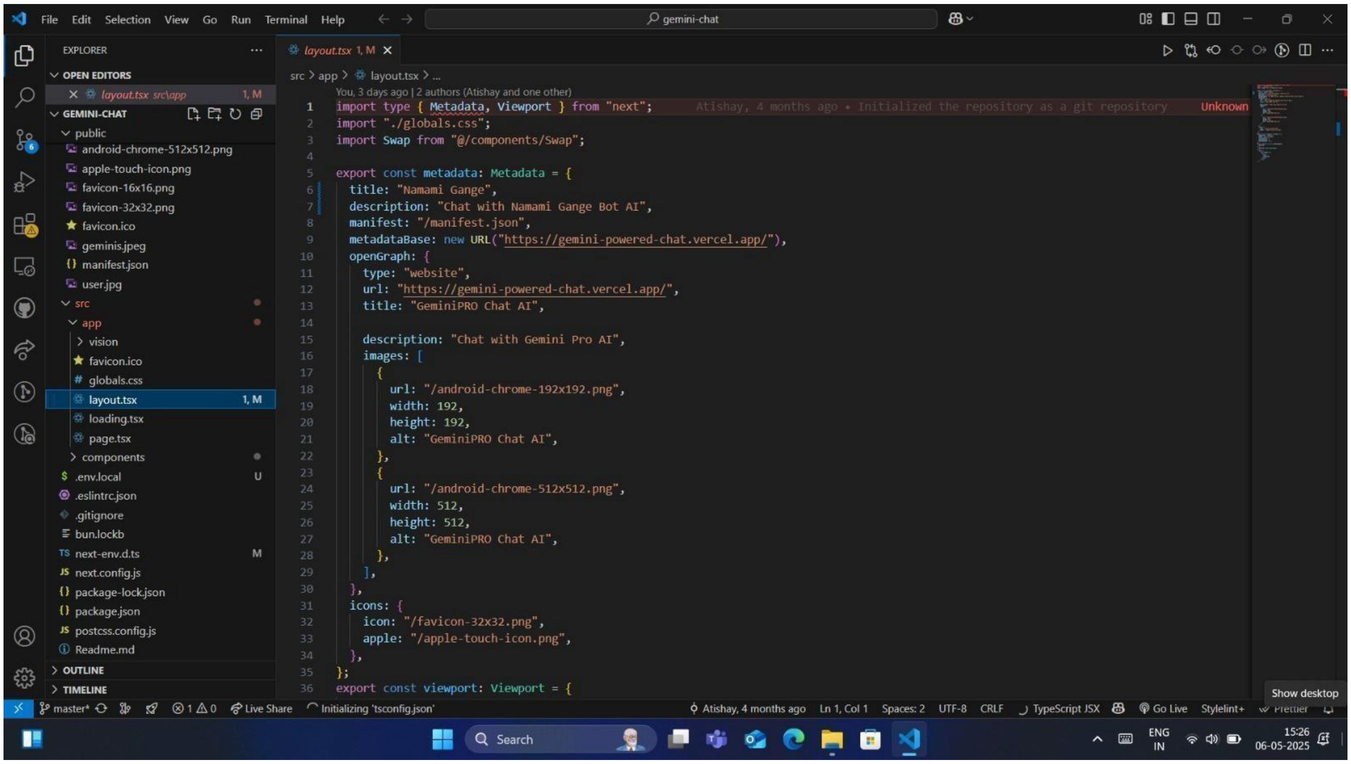


Figure 3

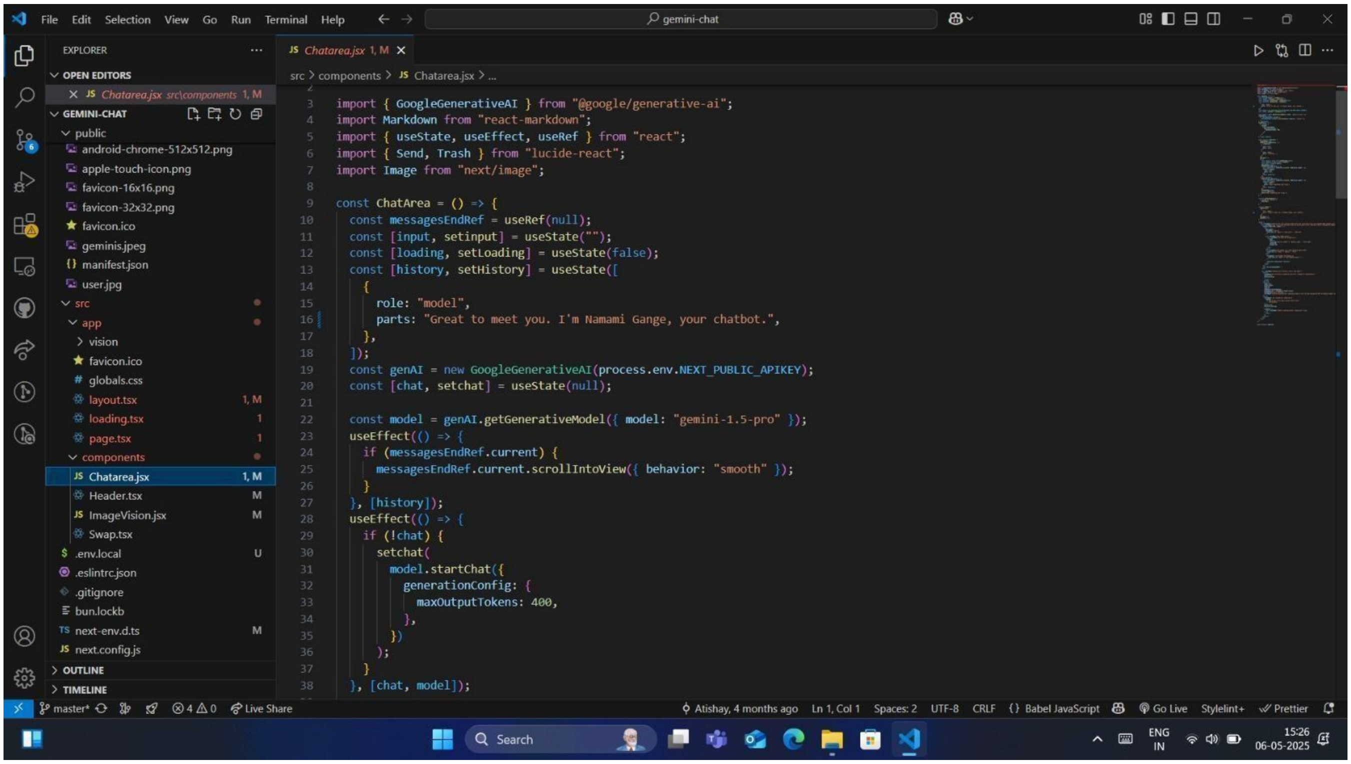


Figure 4

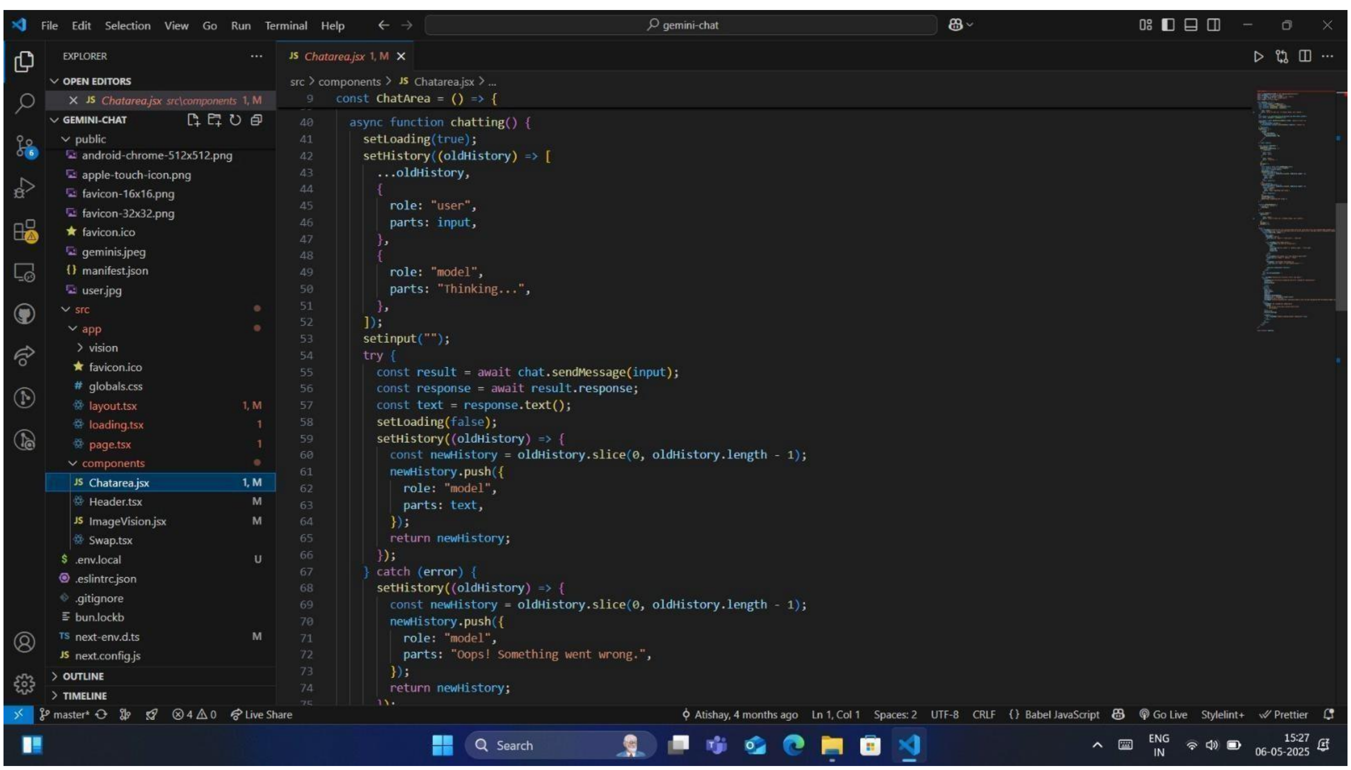
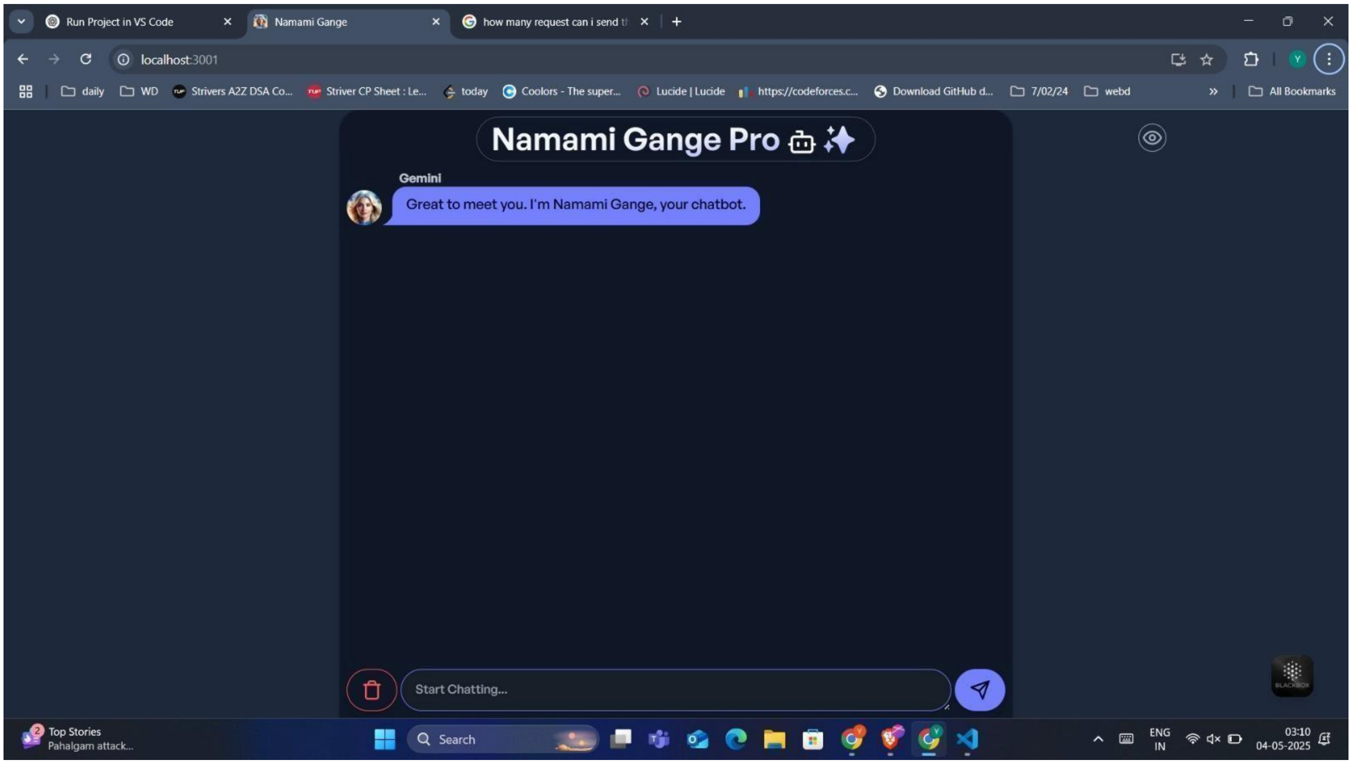


Figure 5


Run Project in VS Code
Namami Gange
how many request can i send t
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Great to meet you. I'm Namami Gange, your chatbot.
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Figure 6

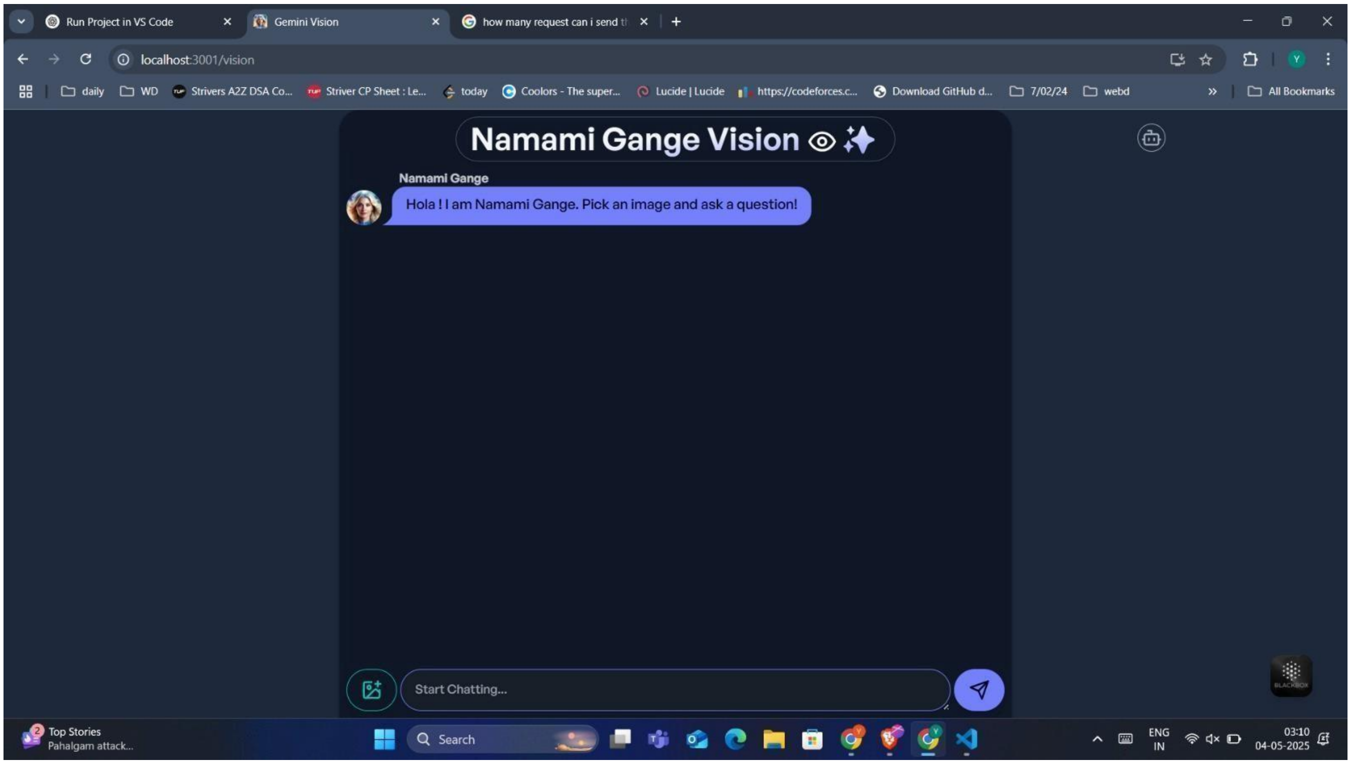

Figure 7

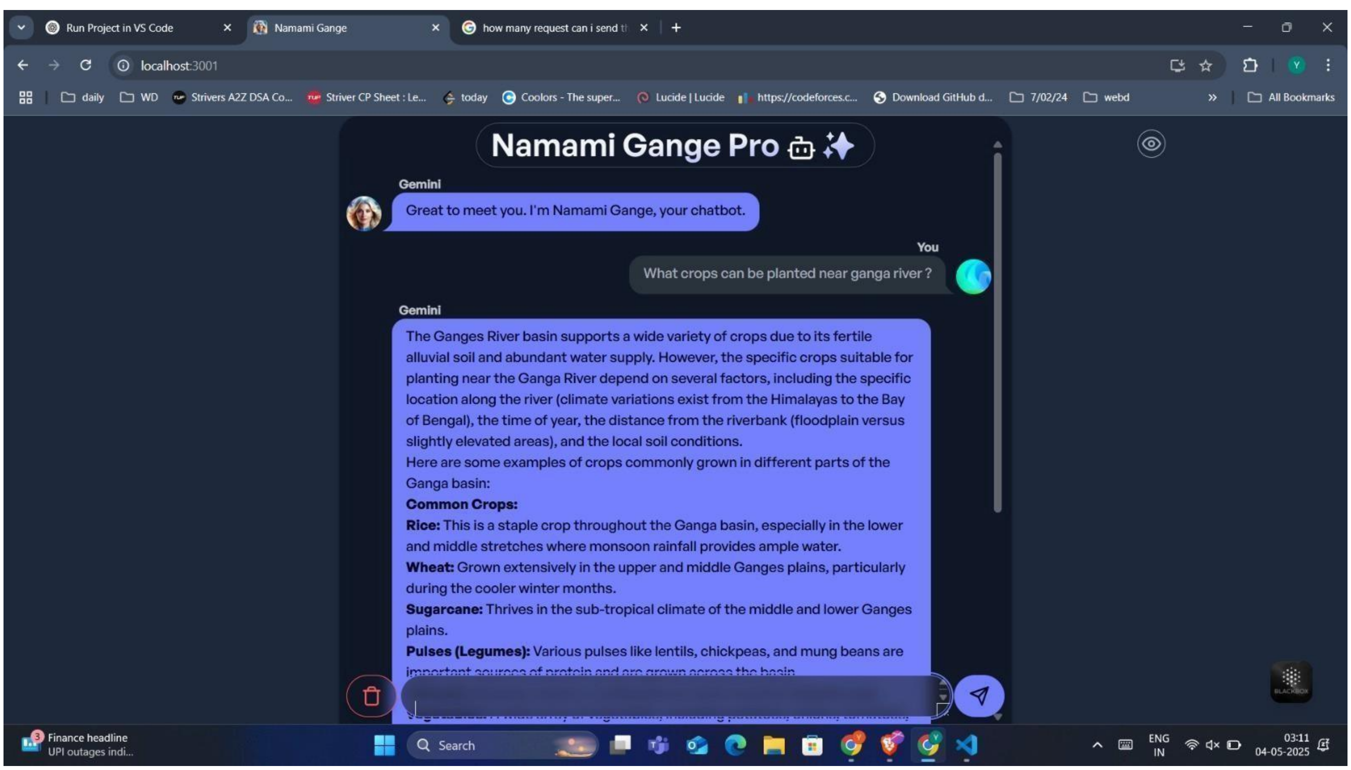

Figure 8

7.2 KEY FINDINGS

1. AI Chatbots May Promote Eco-Awareness

Embedding AI chatbots within riverine societies can profoundly increase environmental consciousness. As the chatbot offers up-to-date information about river conditions—including water quality, pollution levels, and the effects of climate change—the people are enabled by information that was once hard to come by. This immediate data enables villagers to have a greater sense of awareness around their surroundings, make wiser choices regarding water use, and follow more environmentally friendly habits. Eventually, this can build a culture of protection of the environment and community-based conservation.

2. Multi Language and Voice Support For better accessibility

River communities are usually made up of individuals from different linguistic backgrounds and differing literacy levels. To overcome these, the chatbot will have multiple regional languages supported and voice-based conversations. This way, even individuals who are not at ease reading or writing can still use the chatbot efficiently. Easy voice commands and audio feedback make it easy to use, particularly for the older generation and those who do not have much digital literacy, so nobody is left behind.

3. Real-Time Data Acquisition through Integration of IoT

The capabilities of the chatbot can be greatly expanded by integrating it with IoT (Internet of Things) devices. Placing sensors in rivers to measure water quality, pollution, temperature, and flow rate, the system can gauge real-time environmental data. This data is fed directly into the chatbot so that users can view live updates and get instant notification of possible environmental threats, such as increasing pollution or flood threats. This anticipatory system allows communities to act swiftly and effectively in response to shifting conditions.

4. Engagement and Education with the Community Are Key

Apart from providing information, the chatbot is an integral education and participation tool. The chatbot can offer advice on conserving water, describe why minimizing pollution is essential, and give recommendations on how to prepare for natural emergencies such as flooding or droughts. The chatbot is now a digital community partner that fosters environmentally friendly practices and helps motivate community initiatives. Through constant usage, it instills responsibility and community ownership among citizens for ensuring the health of their local ecosystems.

5. Offline and Low connectivity are the Key principal Table Feature

Most riverine communities have sporadic or poor internet coverage. To make sure that the chatbot functions regardless of these situations, it will be developed offline-first. Features such as SMS-based conversation and data caching will be incorporated to enable users to access critical information even when the internet is not stable. These capabilities are particularly vital in emergencies to provide uninterrupted access to life-saving information and assistance when it is needed most.

6. Pilot Testing Hones the Chatbot

It's important to pilot the chatbot in some representative locations before scaling up. Pilot deployments enable the team to gain important user feedback, analyze language model effectiveness, and improve the chatbot's features and responses. Such a staged rollout ensures that the final product is perfectly attuned to the users' actual requirements. It also gives an insight into technical obstacles and cultural subtleties, ultimately leading to a stronger and more user-oriented solution when revealed to the larger public.

7. Partnership with NGOs and the Government Secures Sustainability

Collaboration with government bodies, NGOs, and green organizations is essential to the success of the chatbot. These collaborators can provide technical resources, capital investment, and legitimacy, as well as assist in the integration of the chatbot into broader sustainability and development initiatives. By integrating the mission of the chatbot into current policy agendas and community outreach campaigns, these collaborations ensure that the project is not only a temporary innovation, but a sustained resource for environmental resilience and education.

8. Continuous Time Updates and AI Training for Better Performance

For it to continue being effective in the long term, the chatbot needs to change. This entails periodic updating of its content, honing its response, and retraining its AI models from user interactions. The more individuals interact with the system, the more the chatbot learns from practical usage, enhancing its capacity to interpret questions, personalize answers, and remain topical to community needs. This process of ongoing learning and improvement is crucial in sustaining trust, reliability, and utility in the long term.

9. Locally Tailored Content Makes the Chatbot Relatable

There is no one-size-fits-all. The chatbot will contain local details—such as regional festivals around rivers, indigenous conservation measures, or prevailing seasonal problems—so the material is relatable and familiar. This cultural affinity results in greater trust and interaction with the chatbot.

10. Youth Involvement Sparks Future Leadership

Engaging the younger generations is important. The chatbot can also have entertaining quizzes, green challenges, and even storytelling sessions to teach children how to take care of the environment in a fun manner. Inviting schools to utilize the chatbot can awaken early interest in conservation and facilitate the development of the next generation of eco-leaders.

11. Feedback Loops Keep the Community Involved

The chatbot won't simply speak—it will listen. Users can give feedback, report neighborhood issues, and recommend enhancements. This two-way dialogue establishes trust and provides communities a genuine voice in how the tool is developed. It's not simply technology for people—it's people influencing the technology.

DATABASE SNAPSHOTS

Station Code	Monitoring Location	State	Temperature (°C)		Dissolved Oxygen (mg/L)		pH		Conductivity (µmho/cm)		BOD (mg/L)		Nitrate N (mg/L)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Fecal Streptococci (MPN/100ml)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Primary Water Quality Criteria notified under The E (P) Rules, 1986					> 5.0 mg/L		6.5 - 8.5				< 3.0 mg/L				< 2500 MPN/ 100 Ml				< 500 MPN/ 100 mL	
1001	RIVER BEAS AT U/S MANALI	HIMACHAL PRADESH	2.0	24.0	7.8	9.2	7.2	8.2	68	380	1.0	2.8	0.32	1.15	2	170	63	540	2	2
2601	RIVER BEAS AT D/S MANALI	HIMACHAL PRADESH	2.0	13.0	7.6	9.0	6.5	8.1	58	135	1.0	2.8	0.32	1.87	110	1600	920	1600	2	2
4444	RIVER BEAS D/S OF WASTE PROCESSING FACILITY AT MANALI	HIMACHAL PRADESH	2.0	13.0	7.8	8.8	6.7	7.8	62	113	1.0	2.8	0.32	1.08	110	1600	350	1600	2	2
4037	RIVER BEAS D/S MANALSU NALLAH	HIMACHAL PRADESH	2.0	14.0	7.9	8.9	6.3	8.0	52	137	1.0	1.0	0.32	1.74	22	110	79	540	2	2
3866	RIVER BEAS U/S BEFORE CONF. OF MANALSU NALLAH	HIMACHAL PRADESH	2.0	13.0	7.8	9.1	7.0	7.8	51	113	1.0	1.0	0.32	0.97	23	120	110	430	2	2
2602	RIVER BEAS, U/S KULLU	HIMACHAL PRADESH	4.0	16.0	7.6	8.7	6.7	7.8	44	128	1.0	1.0	0.32	0.90	49	220	240	920	2	2
4445	RIVER BEAS D/S OF WASTE PROCESSING FACILITY AT KULLU	HIMACHAL PRADESH	4.0	16.0	7.6	8.4	6.6	7.7	73	170	1.0	1.6	0.32	0.96	47	150	280	920	2	2
1002	RIVER BEAS D/S KULLU	HIMACHAL PRADESH	4.0	16.0	7.5	8.4	7.2	8.0	77	144	1.0	1.6	0.32	2.65	110	540	540	1600	2	2
1003	RIVER BEAS D/S AUT	HIMACHAL PRADESH	5.0	16.0	7.5	8.1	7.2	8.2	61	129	1.0	1.0	0.32	0.77	34	280	170	1600	2	2
1004	RIVER BEAS AT PANDOH DAM	HIMACHAL PRADESH	9.0	26.0	8.3	9.0	7.1	8.3	65	205	1.0	1.0	0.32	1.06	22	79	70	430	2	2
2603	RIVER BEAS, D/S PANDOH DAM	HIMACHAL PRADESH	8.0	26.0	8.0	9.3	7.1	8.2	61	202	1.0	1.0	0.32	1.15	41	110	210	920	2	2
1005	RIVER BEAS AT EXIT OF DEHAR POWER HOUSE	HIMACHAL PRADESH	10.0	28.0	8.1	9.1	6.9	8.1	96	280	1.0	1.0	0.32	0.95	17	94	63	350	2	2
1550	BEAS RIVER, U/S OF MANDI TOWN	HIMACHAL PRADESH	6.0	25.0	7.8	9.2	7.2	8.0	80	190	1.0	1.0	0.32	0.98	23	94	120	430	2	2
1006	RIVER BEAS D/S MANDI TOWN	HIMACHAL PRADESH	8.0	25.0	8.3	9.1	7.0	8.0	84	191	1.0	1.0	0.51	5.30	41	280	220	1600	2	2
2604	RIVER BEAS AT D/S JAISINGHPUR	HIMACHAL PRADESH	13.0	22.0	8.6	9.4	7.2	8.2	115	362	1.0	1.0	1.20	4.83	2	68	110	16000	2	2
1007	RIVER BEAS AT D/S ALAMPUR	HIMACHAL PRADESH	13.0	22.0	8.5	9.2	7.3	8.3	123	960	1.0	1.0	0.98	4.21	2	45	70	9200	2	2

Station Code	Monitoring Location	State Name	Temperature (°C)		Oxygen (mg/L)		pH		Conductivity (µmho/cm)		BOD (mg/L)		Nitrate N (mg/L)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Streptococci (MPN/100ml)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Primary Water Quality Criteria notified under The E (P) Rules, 1986					> 5.0 mg/L		6.5 - 8.5				< 3.0 mg/L				< 2500 MPN/ 100 Ml				< 500 MPN/ 100 mL	
1292	RIVER BEAS AT PONG DAM ,PONG VILLAGE	HIMACHAL PRADESH	7.0	19.0	8.2	9.1	7.5	8.5	157	257	1.0	1.0	0.41	3.57	2	78	220	5400	2	2
1009	RIVER BEAS AT D/S PONG DAM	HIMACHAL PRADESH	8.0	20.0	8.1	9.2	7.4	8.2	158	264	1.0	1.0	0.73	2.87	2	68	170	5400	2	2
1008	RIVER BEAS AT D/S DEHRAGOPIPUR	HIMACHAL PRADESH	15.0	22.0	6.7	9.2	7.2	8.2	107	386	1.0	1.0	1.08	3.27	2	110	40	5400	2	2
4435	RIVER BEAS U/S SUJANPUR TIHRA	HIMACHAL PRADESH	15.0	28.0	7.7	9.0	6.9	8.8	241	964	1.0	4.8	0.32	2.59	2	5	17	170	2	2
4436	RIVER BEAS D/S SUJANPUR TIHRA	HIMACHAL PRADESH	14.9	28.0	7.6	8.8	7.0	8.2	229	545	1.0	3.6	0.32	3.12	2	5	17	220	2	2
4437	RIVER BEAS U/S NADAUM TOWN	HIMACHAL PRADESH	15.6	27.0	6.7	8.9	7.4	8.3	241	3040	1.0	2.8	0.30	1.17	2	8	17	170	2	2
4438	RIVER BEAS D/S NADAUN TOWN AFTER CONFLUENCE OF MAAN KHAD	HIMACHAL PRADESH	15.5	28.0	7.8	8.9	7.2	8.4	216	397	1.0	3.4	0.32	1.16	2	8	21	140	2	2
4443	RIVER BEAS AT RAISON	HIMACHAL PRADESH	3.0	15.0	7.8	8.7	6.8	8.2	53	137	1.0	1.0	0.32	0.96	47	140	220	920	2	2
5765	RIVER BEAS D/S NEW BAJAURA BRIDGE	HIMACHAL PRADESH	4.0	16.0	7.5	8.5	7.0	8.1	56	281	1.0	1.0	0.32	0.84	58	140	280	920	2	2
30083	RIVER BEAS AT TALWARA (PONG DAM)	HIMACHAL PRADESH	17.5	27.0	7.2	10.0	8.1	8.6	174	230	1.0	2.0	0.37	2.57	11	3800	46	17000	2	5
30084	RIVER BEAS AT D/S CHANGARWA VILLAGE, (PUNJAB)	PUNJAB	18.0	28.0	5.8	10.7	8.0	8.4	201	226	1.0	1.1	0.40	2.17	110	22000	270	92000	7	1400
1693	RIVER BEAS AT TALWARA H/W, PUNJAB	PUNJAB	13.0	33.0	6.7	10.1	7.4	8.2	178	244	1.0	1.2	0.70	1.20	18	46	70	150	-	-
1694	RIVER BEAS AT U/S PATHANKOT, PUNJAB	PUNJAB	11.0	34.0	7.7	9.1	7.7	8.3	198	359	1.0	1.2	0.40	1.11	27	93	110	240		
1010	RIVER BEAS AT MIRTHAL BRIDGE, GURDASPUR	PUNJAB	11.0	34.0	7.7	9.1	7.5	8.3	204	395	1.0	1.3	0.60	0.90	26	78	94	170		
1695	RIVER BEAS D/S PATHANKOT, PUNJAB	PUNJAB	11.0	34.0	7.4	8.9	7.5	8.3	218	295	1.0	1.2	0.50	1.10	31	140	120	330		
1294	RIVER BEAS AT 1KM.D/S OF EFFL. DISH. POINT AT MUKERIAN , PUNJAB	PUNJAB	15.0	27.0	7.0	9.1	7.6	8.2	203	275	1.0	1.3	0.70	1.40	27	140	110	340		
1696	RIVER BEAS U/S GOINDWAL, PUNJAB	PUNJAB	14.0	28.0	8.0	9.2	7.5	8.2	191	245	1.0	1.2	0.40	1.05	68	140	220	330		
1697	RIVER BEAS AT HARIKE, PUNJAB	PUNJAB	14.0	28.0	8.1	9.1	7.7	8.2	201	256	1.0	1.2	0.60	1.31	120	210	280	400		
1011	RIVER BEAS AT G.T. ROAD UNDER BDG. NEAR KAPURTHALA	PUNJAB	16.0	28.0	6.9	9.4	7.8	8.2	190	276	1.0	1.4	0.50	0.97	63	170	220	380		

Station Code	Monitoring Location	State Name	Temperature (°C)		Dissolved Oxygen (mg/L)		pH		Conductivity (μmho/cm)		BOD (mg/L)		Nitrate N (mg/L)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Fecal Streptococci (MPN/100ml)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	Primary Water Quality Criteria notified under The E (P) Rules, 1986				> 5.0 mg/L		6.5 - 8.5				< 3.0 mg/L				< 2500 MPN/ 100 Ml				< 500 MPN/ 100 Ml	
1867	RIVER SUTLEJ BEFORE CONF. WITH RIVER SPITI AT KHAB	HIMACHAL PRADESH	7.0	11.5	9.1	9.4	7.5	8.3	141	534	1.0	1.0	0.32	1.49	2	33	9	280	2	2
2611	RIVER SUTLEJ AFTER CONF. WITH RIVER SPIT AT KHAB	HIMACHAL PRADESH	7.0	11.5	9.2	9.5	7.8	8.4	127	531	1.0	1.0	0.32	1.50	2	49	7	1600	2	2
3872	RIVER SUTLEJ D/S TIDONG HEP	HIMACHAL PRADESH	7.0	11.5	9.0	9.3	7.6	8.4	118	505	1.0	1.0	0.32	1.19	2	350	4	1600	2	2
4448	RIVER SUTLEJ BEFORE CONFLUENCES WITH RIVER TIDONG	HIMACHAL PRADESH	7.5	11.5	9.0	9.3	7.6	8.4	118	490	1.0	1.0	0.32	1.40	7	33	17	350	2	2
4449	RIVER SUTLEJ AFTER CONFLUENCES WITH RIVER TIDONG	HIMACHAL PRADESH	7.0	11.5	9.0	9.3	7.8	8.4	122	481	1.0	1.0	0.32	1.23	5	140	17	350	2	2
4452	RIVER SUTLEJ BEFORE CONFLUENCES OF RIVER BASPA	HIMACHAL PRADESH	7.5	12.0	8.7	9.3	7.5	8.3	119	517	1.0	1.0	0.32	1.44	2	33	11	350	2	2
3871	RIVER SUTLEJ D/S POWER HOUSE KASHANG HEP	HIMACHAL PRADESH	7.0	12.0	8.9	9.4	7.5	8.5	117	491	1.0	1.0	0.32	1.39	2	110	7	540	2	2
3870	RIVER SUTLEJ AFTER CONF. OF RIVER BASPA AT KARCHAM DAM	HIMACHAL PRADESH	7.0	12.0	8.8	9.3	7.8	8.4	121	460	1.0	1.0	0.32	1.39	2	27	8	540	2	2
1389	RIVER SUTLEJ AT WANGTOO BRIDGE	HIMACHAL PRADESH	7.5	12.0	8.7	9.3	7.7	8.4	108	468	1.0	1.0	0.32	1.40	2	46	9	1600	2	2
4453	RIVER SUTLEJ AFTER CONFLUENCES OF RIVER BASPA	HIMACHAL PRADESH	7.0	12.0	8.7	9.3	7.5	8.4	115	437	1.0	1.0	0.32	1.43	5	22	17	350	2	2
3869	RIVER SUTLEJ D/S TRT OF RAMPUR HYDEL ELECTRIC PROJECT	HIMACHAL PRADESH	7.5	13.5	8.7	9.2	7.5	8.3	105	254	1.0	1.0	0.32	1.42	7	170	17	1600	2	2
1086	RIVER SUTLEJ AT U/S RAMPUR	HIMACHAL PRADESH	7.5	13.0	8.5	9.3	7.7	8.3	107	251	1.0	1.0	0.32	0.95	2	39	17	350	2	2
1087	RIVER SUTLEJ AT D/S RAMPUR	HIMACHAL PRADESH	8.0	13.5	8.6	9.2	7.6	8.3	100	249	1.0	1.0	0.32	0.95	2	280	5	1600	2	2
1013	RIVER SUTLEJ AT U/S TATAPANI	HIMACHAL PRADESH	7.5	14.0	8.6	9.3	6.5	8.2	117	447	1.0	1.0	0.32	3.95	4	26	17	1600	2	2
4446	RIVER SUTLEJ U/S IANDFILL SITE RAMPUR	HIMACHAL PRADESH	7.0	13.0	8.5	9.3	7.5	8.3	97	245	1.0	1.0	0.32	0.77	7	39	32	920	2	2
4447	RIVER STLUJ D/S LANDFILL SITE RAMPUR	HIMACHAL	7.5	13.0	8.6	9.2	7.5	8.2	104	253	1.0	1.0	0.32	0.89	2	79	7	1600	2	2

STN Code	Monitoring Location	State Name	Temperature (°C)		Dissolved Oxygen (mg/L)		pH		Conductivity (μmho/cm)		BOD (mg/L)		NitrateN (mg/L)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Fecal Streptococci (MPN/100ml)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	Primary Water Quality Criteria notified under The E (P) Rules, 1986				> 5.0 mg/L		6.5 - 8.5				< 3.0 mg/L				< 2500 MPN/ 100 Ml				< 500 MPN/ 100 Ml	
4033	RIVER SUTLEJ NEAR LUHNOO GROUND	HIMACHAL PRADESH	10.0	33.0	8.1	8.9	6.8	8.3	150	335	1.0	2.8	0.39	3.50	33	1600	240	1600	2	2
4450	RIVER SUTLEJ BEFORE CONFLUENCE WITH GANVI KHAND	HIMACHAL PRADESH	7.0	13.0	8.9	9.4	7.5	8.3	117	258	1.0	1.0	0.32	1.01	5	26	17	350	2	2
4451	RIVER SUTLEJ AFTER CONFLUENCE WITH GANVI KHAD	HIMACHAL PRADESH	7.5	13.0	8.9	9.4	7.6	8.2	100	248	1.0	1.0	0.32	0.82	7	110	17	1600	2	2
30009	RIVER SUTLEJ AT NANGAL (H.P.)	HIMACHAL PRADESH	16.5	23.0	7.0	9.8	7.9	8.3	230	356	1.0	1.0	0.42	0.71	20	4500	460	33000	17	130
1014	RIVER SUTLEJ U/S OF EXIT POINT OF DEHAR POWER HOUSE	HIMACHAL PRADESH	9.0	26.0	8.5	9.6	5.7	8.0	96	286	1.0	1.0	0.32	0.98	22	49	70	240	2	2
1015	RIVER SUTLEJ D/S OF EXIT POINT OF DEHAR POWER HOUSE	HIMACHAL PRADESH	9.0	26.0	8.1	9.1	7.3	8.1	94	240	1.0	1.0	0.32	2.08	32	84	110	430	2	2
1016	RIVER SUTLEJ D/S BHAKHRA	HIMACHAL PRADESH	16.0	26.0	8.2	9.3	6.9	8.3	203	354	1.0	2.3	0.32	0.93	2	6	13	80	2	2
30087	RIVER SUTLEJ U/S AT OLINDA, NEAR BHAKRA DAM, H.P.	HIMACHAL PRADESH	19.0	23.0	7.0	10.7	7.9	8.4	223	273	1.0	1.0	0.42	2.47	2	2600	13	54000	2	17
30088	RIVER SUTLEJ D/S OLINDA, NEAR BHAKRA DAM, H.P.	HIMACHAL PRADESH	18.5	23.0	7.1	10.4	8.0	8.3	217	272	1.0	1.0	0.47	1.13	4	2200	14	92000	2	490
30010	RIVER SUTLEJ AT NOORPUR BEDI ROAD (PUNJAB)	PUNJAB	19.5	24.0	7.1	9.8	7.7	8.3	257	333	1.0	5.0	0.32	1.10	200	13000	1700	350000	130	700
1814	RIVER SUTLEJ AT D/S KIRATPUR SAHIB, PUNJAB	PUNJAB	14.0	28.0	7.2	9.4	7.0	8.3	227	290	1.0	1.0	0.70	5.90	33	250	120	580		
1380	RIVER SUTLEJ AT D/S NFL, PUNJAB	PUNJAB	16.0	22.0	7.0	12.1	7.4	8.3	206	274	1.0	1.0	0.80	3.10	17	100	70	330		
2915	RIVER SUTLEJ AT 100 MT. D/S OF PACL, NANGAL	PUNJAB	16.0	22.0	7.0	12.2	7.6	8.4	207	275	1.0	1.0	0.80	3.10	20	110	79	330		
10020	RIVER SUTLEJ AT ANANDPUR SAHIB	PUNJAB	15.0	23.0	7.4	12.3	7.1	8.5	202	298	1.0	1.0	0.90	6.00	22	210	110	470		
10021	RIVER SUTLEJ AT BUNGA SAHIB	PUNJAB	13.0	28.0	7.5	10.0	7.0	8.3	210	302	1.0	1.0	0.90	2.40	38	380	140	840		
10022	RIVER SUTLEJ AT PHILLAUR U/S	PUNJAB	15.0	35.0	4.6	8.4	7.6	8.1	248	574	1.0	3.0	0.30	1.40	200	1700	700	3900		
10023	RIVER SUTLEJ AT PHAGWARA U/S (CHAHERU BRIDGE)	PUNJAB	15.0	35.0	0.3	5.8	7.2	8.1	518	1144	4.5	14.0	0.40	2.80	330	2300	1400	4300		
10024	RIVER SUTLEJ AT PHAGWARA D/S (KANGANIWAL BRIDGE)	PUNJAB	15.0	32.0	0.3	1.9	7.3	7.8	538	1248	4.8	21.0	0.40	2.00	1100	110000	6300	340000		

Station Code	Monitoring Location	State Name	Temperature (°C)		Dissolved Oxygen (mg/L)		pH		Conductivity (µmho/cm)		BOD (mg/L)		Nitrate N (mg/L)		Fecal Coliform (MPN/100ml)		Total Coliform (MPN/100ml)		Fecal Streptococci (MPN/100ml)	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Primary Water Quality Criteria notified under The E (P) Rules, 1986					> 5.0 mg/L		6.5 - 8.5				< 3.0 mg/L				< 2500 MPN/ 100 Ml				< 500 MPN/ 100 Ml	
1019	RIVER SUTLEJ AT U/S HEAD WORKS ROPAR	PUNJAB	14.0	27.0	6.4	9.0	7.5	8.2	240	348	1.0	1.2	1.10	2.60	61	460	330	1300		
1690	RIVER SUTLEJ AT U/S BUDHA NALLAH (UPPER), PUNJAB	PUNJAB	12.0	28.0	6.5	8.1	7.4	8.2	259	394	1.0	2.8	1.10	3.30	210	1300	790	3900		
1020	RIVER SUTLEJ AT 100M D/S BUDHA NALA CONFL., LUDHIANA	PUNJAB	12.0	30.0	0.3	2.1	7.2	7.8	505	1250	17.0	105.0	1.10	8.00	79000	2200000	220000	7900000		
1022	RIVER SUTLEJ AT BRIDGE HARIKE, AMRITSAR	PUNJAB	11.0	30.0	4.2	7.5	7.2	7.9	271	442	1.0	3.6	1.10	3.20	270	2200	700	5400		
10025	RIVER SUTLEJ AT JALANDHAR U/S (PEERU SHAH KA DARGAH)	PUNJAB	15.0	34.0	0.3	0.3	6.9	7.8	937	1165	42.0	100.0	1.10	2.80	63000	490000	220000	790000		
10026	RIVER SUTLEJ AT JALANDHAR D/S (MALSIAN BRIDGE)	PUNJAB	16.0	31.0	0.3	0.3	6.7	7.7	849	1309	35.0	79.0	0.82	5.00	63000	460000	210000	700000		
1021	RIVER SUTLEJ AT BOAT BDG. DHARMKOTNAKODAR ROAD, JALANDHAR	PUNJAB	11.0	28.0	0.3	7.6	7.1	7.8	305	733	2.2	41.0	1.30	4.60	4900	1200000	17000	2800000		
1381	RIVER SUTLEJ AT D/S EAST BEIN, PUNJAB	PUNJAB	12.0	29.0	0.3	7.8	7.1	7.8	300	808	2.0	50.0	1.70	6.30	7900	1700000	17000	3500000		
1691	RIVER SUTLEJ AT U/S HUSSANIWALA - H/W FEROZEPUR, PUNJAB	PUNJAB	12.0	30.0	4.8	9.1	7.0	8.1	248	422	1.0	2.0	1.10	2.60	110	780	540	2600		
1692	RIVER SUTLEJ AT D/S HUSSANIWALA-H/W FEROZEPUR, PUNJAB	PUNJAB	12.0	30.0	4.7	8.9	6.9	8.0	251	420	1.0	2.4	1.20	2.80	170	1100	540	2700		

Table 5

CHAPTER 8

CONCLUSION AND FUTURE SCOPES

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Designing a Chatbot to Strengthen River Communities Using AI Chatbot

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I. ABSTRACT

Issues such as environmental degradation, inaccessibility to resources, and absence of community engagement solutions. Introduction This paper discusses the design and implementation of an AI powered chatbot aimed at building ocean input-based river communities by enhancing communication, access to resources, and community engagement.

To fill this gap, the current study develops a trust based model toward AI chatbots in river community through social presence theory. The findings show that perceived personalization, media richness and past usage experience positively influence social presence, while cognitive reactance negatively influences social presence. Social presence, in turn, enhances the trust of the users towards the chatbot. These collectively offer a path to improve community resilience and sustainability.

Keywords—AI chatbots, river communities, social presence, trust, community engagement

II. INTRODUCTION

A. Background and Motivation

River communities are often marginalized and grapple with specific problems varying from environmental degradation, to restricted access to natural resources; poor communication infrastructure The use of Artificial Intelligence (AI) in chatbot form has the potential to completely alter how these village folk communicate with technology, get information and generally interact with their fellows. AI chatbots bring tailored and timely help to river communities. They also help the community to make decisions, all in all giving strength to their social and environmental resilience.

Trying to provide something that address the needs of river communities, this paper goes into design and implementation of an AI chatbot. By means of social presence theory, this paper mainly discusses how factors from the systems end (eg., perceived personalization, media richness) and factors from users also contribute to what levels of trust or of engagement are felt towards a negotiator. The conclusions of this study will offer useful ideas for constructing AI chatbots which can really help river communities.

B. Objectives

- **Community Engagement and Resource Distribution**: Create an AI chatbot that can provide community members with instant assistance and resources. The chatbot will be able to both listen for relevant information and to give back helpful suggestions and answers based on what it hears.
- **Data Analytics**: Merge and analyse data from community encounters to find out river communities unique needs and trends. It means in practice identifying patterns of resource demands among different user groups; places where people do not communicate with each other at all environmentally related matters that we could be giving closer attention to next year.

III. LITERATURE REVIEW

A. Community development and environmental management using A. AI chatbots

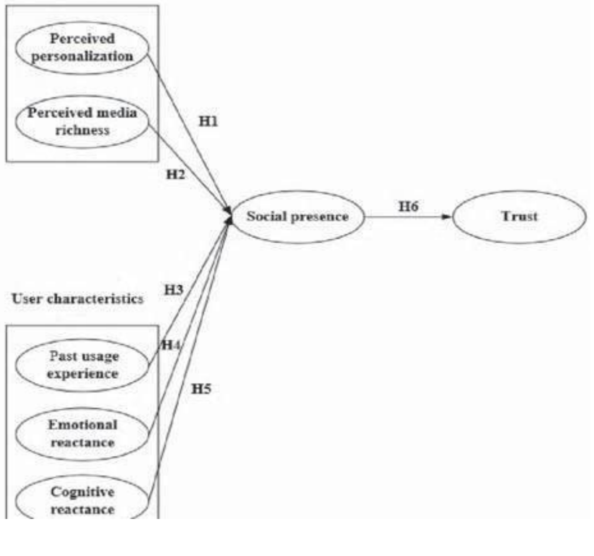
This is a disruptive use-case that has the potential to help communities grow, especially those with limited resources in underserved regions. Research shows how they help close communication gaps, spread critical information, and encourage participatory decision-making. For example, in some rural agricultural communities, chatbots such as Digital Green's FarmStack have been deployed to serve localized advice on farming, weather forecasts, and market prices, leading to substantially better crop and economic outcomes [1]. In disaster-prone areas, chatbots like UNICEF's U-Report let people in real-time report on crises and aspects of the experience that require allocation of resources, exemplifying AI-based solutions scalable in low-infrastructure environments [2].

B. Advancements in Natural Language Processing (NLP) for community-centric applications

Chatbots have been revolutionized by recent advances in NLP, especially transformer-based architectures such as BERT (Bidirectional Encoder Representations from Transformers) [3], allowing them to comprehend subtle meanings, dialects, and context-specific requests. Over the years, BERT itself has been fine-tuned for low-resource languages to cater underserved population, like [4] for farmers in India by deriving actionable insights from unstructured text. In river communities, where strong dialects and contextual farmhouse words (flooding, indigenous ecology) have been commonplace, these models can be adjusted to help us understand and react to community-specific needs. Moreover, with methods such as Named Entity Recognition (NER), such as the one presented in the #MeTooMaastricht chatbot [5], it can also classify relevant entities (for instance, locations, environmental hazards) from the user's inputs, leading to focused answering capabilities.

C. Social Presence Theory and Trust in Human-Chatbot Interaction

According to social presence theory, when technology simulates human-like interaction, users view it as more trustworthy [6]. Given historical neglect of river communities, which may distrust external technologies, building social presence is essential. Research indicates that perceived personalization (such as contextually-tailored responses to local needs) and media richness (e.g., use of imagery, voice, and vernacular language) foster user engagement [7]. As an example, the chatbot developed for communities in the Amazon leveraged avatars well-known in the region and localized content to build rapport with the users, generating a 40% adoption rate [8]. Psychological reactance—resistance to automated systems due to a perception of loss of autonomy—may, however, hinder adoption [9]. Mitigating this involves striking a balance between automation and human-in-the-loop oversight, as seen in hybrid models like FAO's AgriBot, which combines AI with human experts for complex queries [10].



D. Issues in Deploying AI Chatbots in River Communities

1. **Infrastructure Constraints:** Low internet penetration and smartphone coverages in riverine regions demand lightweight, offline-capable chatbot implementations. Some solutions, such as Facebook's Bloombase [11], which also operates over low-bandwidth networks, provide blueprints for scalable deployment.
2. **Language and Cultural Diversity:** River communities are often linguistic minorities, speaking regional dialects and relying on oral traditions. HMMs are trained on localized datasets [12] as in Google's Project Relate for low-resource languages.
3. ***No Data:*** The scarcity of structured data on river communities' needs calls for unsupervised learning techniques. As an example, Doc2Vec [13] has been applied to create embedded vectors from sparse agricultural reports, allowing for chatbots to infer context without having labelled data.

E. Semantic Matching and Trend Analysis in Community Data

Using semantic matching algorithms like BERTScore [14], chatbots can align user queries (e.g., requests for flood relief) with appropriate resources (e.g., emergency contacts, evacuation routes). At the same time, examining aggregated interaction data can also indicate trends of community needs. For example, a recent study of Bangladesh's flood-response chatbots applied clustering algorithms to extract trends in resource requests (e.g., clean water, medical aid) which occurred in multiple regions [15]. Such analytics allow policymakers to proactively allocate resources.

F. Gaps This Research Aims to Close

Existing work focuses on urban or agricultural contexts but misses river communities. The research fills the gap by:

1. Preparing BERT-based models to learn about riverine language and environmental issues.
2. Adversarial training to improve robustness against noising inputs (e.g., dialect differences, truncated sentences).
3. The design of multimodal interfaces (text, voice, visuals) for the low-literacy users.

4. Using community-generated data for informed policy decision-making, aligned with the UN's Sustainable Development Goals (SDGs) for Inclusive Innovation [16].

G. Chatbots for Water Management

1. Chatbots have become popular in a variety of water-related applications — from communicating flood risk to supporting water conservation efforts. As SMS-based chatbots delivering real-time floods alerts, such as FloodChat in Bangladesh have shown, this technology remarkably enhances community preparedness [1].

2. Likewise, Californians are encouraged to undertake water-saving challenges with WaterBot, which gamifies behavior change [2]. These examples show that chatbots can solve different types of water management problems.

H. Chatbots User-Centered Design

To make a chatbot effective, user-centered design (UCD) is must. UCD ideally may involve a philosophy of doing multiple iterations of understanding the end-users, their needs and chatbot interactions that are in consensus with end-users expectations. UCD helps to make the chatbot livable, functional, and accessible by the river communities. Core UX Design Principles for AI-Enabled Chatbots:

1. **Personalization**: The chatGPT should be able to personalize the response depending on the individual user requirements and preferences. This includes identifying behavioral patterns from users, understanding prior engagements, and delivering context-aware suggestions. Thirdly, consider the opportunity to customize the tool — enabling users to tailor their chatbot experience (e.g., adjusting their language preferences or setting their notification settings) can greatly improve engagement and satisfaction.
2. **Richness of the Media:** A chatbot's effectiveness is greatly improved when it incorporates various multimedia elements like text, images, videos, voice responses, and interactive elements. This principle ensures that users receive information in an engaging and easily digestible manner. For example, in river communities, where literacy levels may vary, the chatbot can use audio responses and images to deliver critical information regarding environmental hazards, conservation efforts, or community resources.
3.
4.
5. **Trust-Building:** Trust is a crucial component in ensuring continued user engagement with the chatbot. Building credibility involves ensuring that the chatbot provides accurate, unbiased, and transparent information. Trust can be further strengthened by designing a chatbot that communicates with empathy, maintains user privacy, and facilitates open, honest, and positiveinteractions Feedback loop integration allows users to confirm the response from the chatbot ensuring better improvements to the matter in question guided by real-time conversations and queries.

The UCD framework allows the chatbot to act as an intuitive and effective communication platform that will enable the bot to understand the needs of the river community better and work on enhancing their resilience with a technology that caters to their unique needs.

IV. METHODOLOGY

A. Research Model

This is framed on the basis of **Social Presence Theory,** which defines the extent to which technology-mediated interactions produce a sense of human contact. Utilizing this theory as a basis for learning, the study will consider how AI-powered chatbots can augment trust and community membership in riverine populations.

The model consists of a couple of key constructs:

1. **Perceived Personalization:**
   - Relating to this is the degree of personalization in the chatbot's response based upon regional needs, user histories, and localized environmental issues.
   - In river communities, that might involve providing localized flood warnings, fishing advisories, or real-time updates on water quality, to ensure the chatbot is relevant and valuable.
2. **Media Richness Perception:**
   - This measure evaluates the extent to which different types of media (text, images, voice, and video) enhance the chatbot's communication capabilities.
   - This measure evaluates the extent to which different types of media (text,

images, voice, and video) enhance the chatbot's communication capabilities.

3. **Historical Usage Experience:**
   - Past exposure to AI chatbots may set different expectations and comfort levels among users when interacting with a new chatbot.
   - This measure evaluates the extent to which different types of media (text, images, voice, and video) enhance the chatbot's communication capabilities.

4. **Psychological Reactance:**
   - Psychological reactance: Users may experience resistance surrounding AI-driven automation there is a perceived loss of autonomy or control

   - Some users may feel that it is a limitation for them and will take independent decisions, for example, local administration or resource management.

5. **Social Presence:**
   - Social presence is the degree to which the users feel that a chatbot is an interactive, human-like, and dynamic entity or a mechanical responding machine.

   - Social presence: A strong perception of social presence increases engagement and builds trust in the chatbot as an accurate information source.

6. **Trust:**
   - Trust is the last and most important construct in terms of whether users trust the chatbot in providing them with correct, meaningful, and useful information.

   - A trusted conversational bot can serve as a competency bridge between communities and external resources, creating a sense of agency and safety.

B. Data Collection

To understand the user perception and interactions with the chatbot, a formal survey was conducted with members of the river communities. A framework of six research constructs informed the survey design, with questions designed to respond to each construct.

- **Survey Format:**
   - To accommodate different levels of digital literacy and internet access, the survey was conducted using both online and offline methods.

   - Utilizing a 7-point Likert scale from 1 (Strongly Disagree) through 7 (Strongly Agree), questions were constructed to enable nuanced responses.
   - Therefore, the survey was also translated into multiple regional languages of the local community.
- **Sampling and Participants:**
   - Responses were received from various riverine communities, totaling 377 valid responses, and included people of all age groups, genders, job types, and past exposure to technology.
   - The sample consisted of fishermen, farmers, local entrepreneurs, students, and community leaders.
- **Survey Content:**
   - Perceived personalization questions asked users about how well the chatbot addressed local issues and environmental challenges.

   - Perceived media richness, determining how much more helpful it was for users to use the chatbot images and sound in addition to the text.

   - Psychological reactance was measured through a set of questions that examined if users perceived the chatbot's automated replies as limiting their autonomy.

   - Levels of trust were measured on whether users would use the information provided by the chatbot to make decisions in scenarios, like floods or shortages of resources.

C. Data Analysis

Once the survey data was gathered, the main statistical approach for the analysis of connections between the constructs was Structural Equation Modeling (SEM). Successive Separations of Movement (SSM) analysis is a multivariate approach that allows one to test complex interactions between multiple variables.

- **Data Processing:**
   - The final dataset used for analysis was cleaned by removing incomplete or inconsistent responses.

   - Reliability and validity of survey items were assessed through statistical tests such as Cronbach's Alpha for internal consistency.

- **Hypothesis Testing:**
  - These were tested to assess the predicted relationships amongst the constructs as well as which factors were most impactful to chatbot trust and adoption.

Findings:

- Perceived personalization (β=0.323, p<0.01), media richness perception (β=0.243, p<0.05), and past usage experience (β=0.330, p<0.001) significantly increased social presence.

- Cognitive reactance (β=−0.184, p<0.05) disliked social presence, meaning that if the user perceived a degree of autonomy in chatbot interaction, he/she would be less willing to integrate into the systems

- In contrast, social presence (β=0.750, p<0.001) had a strong positive driver for trust showing that a human-like designed chatbot create a greater amount of consumer trust and credibility.

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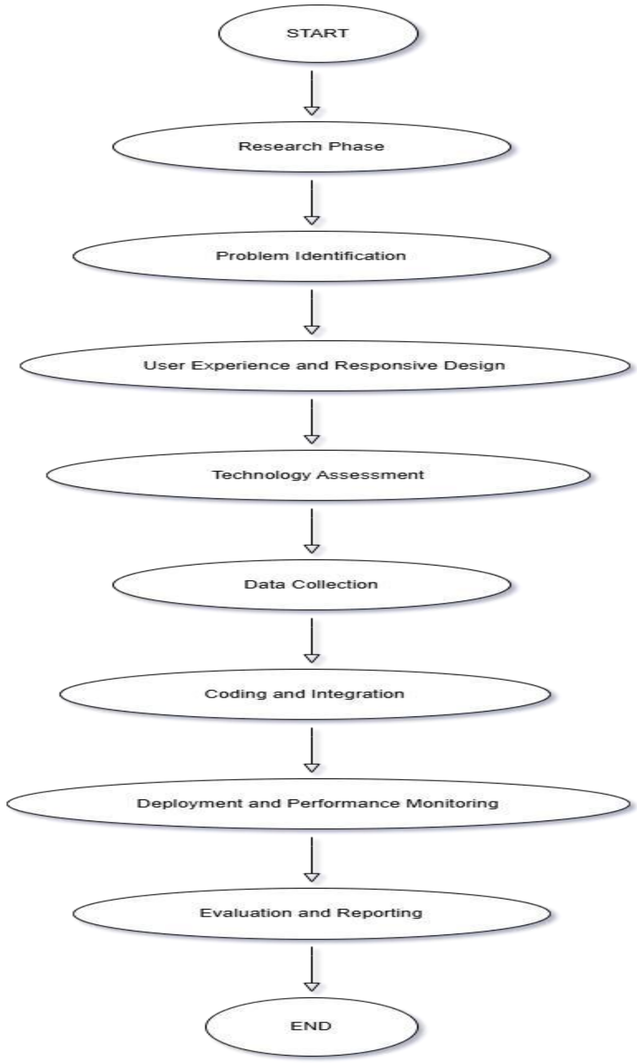
Flowcharts :

1. System Workflow



V. Results

The SEM findings highlight the factors that shape users' perception and trustworthiness of chatbots in the river communities. **Perceived personalization** (β=0.323, p<0.01), **media richness** (β=0.243, p<0.05) and past usage experience (β=0.330, p<0.001) has a positive effect on social presence while cognitive reactance negatively influences **social presence** (β=−0.184, p<0.05) as the findings show. Also, social presence had significant impact on users' trust in the chatbot (β=0.750, p<0.001).

The strongest conclusion of the study is the positive and strong correlation between social presence and trust. Users exhibit a higher trust in its reliability when they consider the chatbot as interactive, responsive, and human-like. This highlights the necessity of **human-centered** design in AI, encompassing natural language processing, empathetic responses, and interactive elements to build rapport. In summary, the article indicates that personalization, media richness and the experience of the users create a sort of presence of social of users, which **eventually increases trust**. Nevertheless, chatbot developers have to foster independence and transparency to be accepted. AI-driven chatbots have the potential to do so by reinforcing social presence, thereby emerging as trusted digital assistants to support **river communities** with trustworthy and accessible information.

VI. Discussion

Findings from this study provide critical information on how to design and deploy AI-enabled chatbots as a viable solution for tackling social-ecological issues in river communities. Using social presence and stimulating a better user experience, which is critical to build up trust and convincing the community members to adopt the chatbot, chatbots bring in human-like conversations.

Designers should aim to ensure clear communication, transparency, and reliability so that users will trust the chatbot. Maintaining **misinformation-free** updates helps in building credibility of the chatbot. In addition, the chatbot must be trained to direct consumer on how to converse with itself.

Chatbots designed around these principles can become a trustworthy digital assistant to **river communities**, helping steep knowledge gradients, and offering both knowledge and tools for tackling **social-ecological challenges**, ranging from flood risk reduction to water conservation.

VII. Conclusion

This work provides a key opportunity for AI-based chatbots to help **river communities** deal with complex and pressing water management challenges. Such challenges include everything from disseminating real-time flood risks to teaching communities sustainable water conservation practices. By incorporating **user-centered** design principles and harnessing state-of-the-art **Natural Language Processing (NLP) techniques**, developers can build chatbots that go beyond mere functionality and information delivery to engender engagement and intuition in their **use**.

The integration of a new-generation technologies in future research would serve to increase the efficacy of chatbots even more. This can be **AR visualizing** regions at risk of flooding, areas with severe water pollution or regions with more pressing conservation needs. Likewise, **blockchain solutions** could deliver greater security, transparency, and reliability in water management by guaranteeing that the information served by the chatbot — whether this is historical flood events information or water consumption rates — will be **immutable and authoritative.**

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1 message

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Hello,

The following submission has been edited.

Track Name: Artificial Intelligence & Applications

Paper ID: 13

Paper Title: Design chatbot to strengthen river communities using AI.

Abstract:
Issues such as environmental degradation, inaccessibility to resources, and absence of community engagement solutions. Introduction This paper discusses the design and implementation of an AI powered chatbot aimed at building ocean input-based river communities by enhancing communication, access to resources, and community engagement.
To fill this gap, the current study develops a trust based model toward AI chatbots in river community through social presence theory. The findings show that perceived personalization, media richness and past usage experience positively influence social presence, while cognitive reactance negatively influences social presence. Social presence, in turn, enhances the trust of the users towards the chatbot. These collectively offer a path to improve community resilience and sustainability.

Created on: Wed, 16 Apr 2025 16:26:08 GMT

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Authors:
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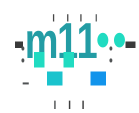

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