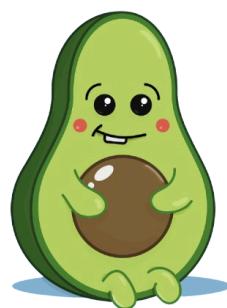




# DEEP LEARNING

## lab project



Grow to Glow :



Grow with love, eat with joy – your AI buddy in Goa!

Msc AI Part 1

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# Introduction

The need for specialized farming advice is crucial, especially in regions with unique agricultural challenges.



We believe that every garden, farm, and balcony in Goa has the potential to bloom beautifully with the right support.

This project presents Grow To Glow, an AI-powered chatbot designed to provide Goa-specific plant-growing advice.



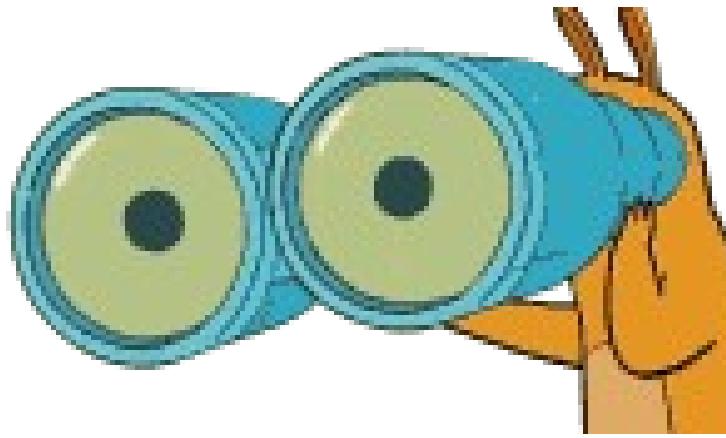
Goa's coastal saline environment, laterite soils, and monsoon patterns require farming practices that are tailored to the specific needs of the land. General advice often lacks the regional nuances necessary for successful cultivation.

In addition to farming guidance, Grow to Glow is also equipped to offer basic dietary advice, focusing on the use of local fruits and vegetables for common health conditions such as diabetes, hypertension, and obesity



While it is not a replacement for professional medical consultation, it provides users with safe, well-known recommendations rooted in regional produce. By connecting agricultural knowledge with everyday health needs, Grow to Glow aims to support the people of Goa in cultivating not just their crops, but also healthier lifestyles

# Objectives



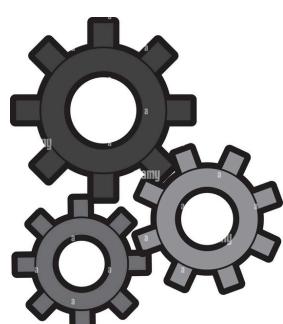
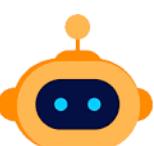
The main objectives of the Grow To Glow project are:



1 : Develop an AI-powered chatbot to provide personalized farming advice tailored to Goa's unique agricultural conditions, including its coastal saline environment, laterite soils, and monsoon patterns.



2 : Implement an efficient similarity search mechanism using sentence embeddings (all-MiniLM-L6-v2) and FAISS indexing.



3 : Integrate a Retrieval-Augmented Generation (RAG) model to generate contextually accurate, conversational responses.

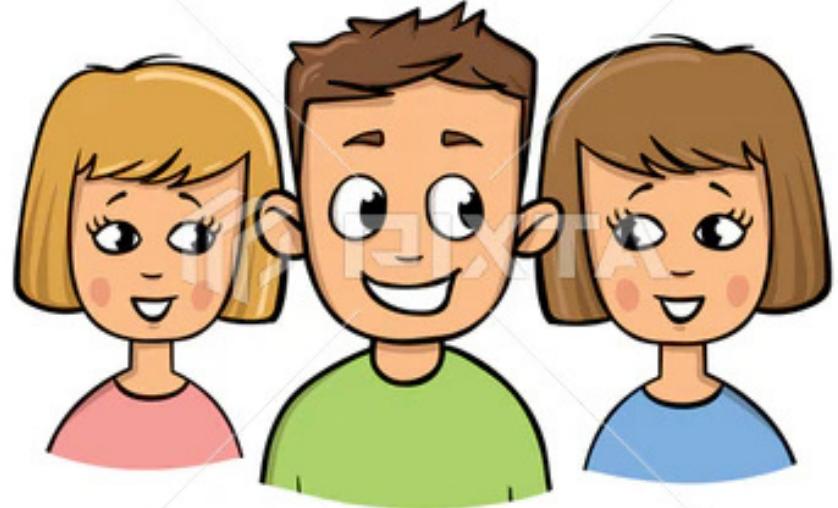


4 : Offer personalized advice covering soil types, fertilization, seasonal plant care, and more.

5 . Ensure easy access through a user-friendly interface for both web and mobile platforms, allowing users to engage seamlessly with the chatbot for agricultural and dietary support.



# Motivation

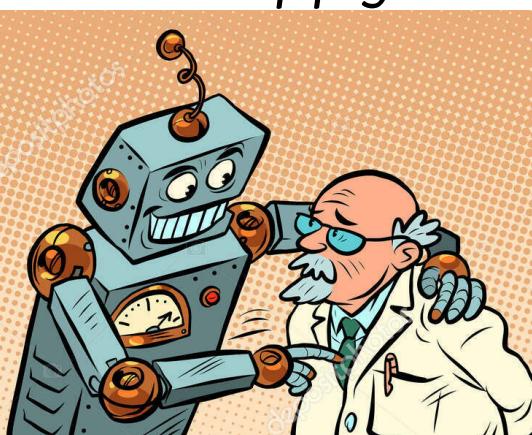


Farming in Goa presents unique challenges due to its coastal saline soil, seasonal monsoons, and varying microclimates. Traditional farming advice often fails to address these regional nuances, which can hinder local farmers and gardeners. This is where Grow to Glow comes in—an AI-powered chatbot designed to offer personalized guidance based on Goa's specific agricultural conditions.

The motivation behind this project stems from the desire to make farming support more accessible, practical, and tailored to the region. By combining deep learning and local agricultural knowledge, we aim to empower farmers and gardeners to enhance both productivity and sustainability in Goa.

This project would not have been possible without the constant guidance and inspiration of our professor Professor S. Bhaskar Sir.

His encouragement pushed us to think beyond textbooks and apply what we learned in a real-world scenario



His belief in using AI for local, meaningful impact made him a key figure in our project. His guidance helped us recognize the potential of merging deep learning with agriculture.

Without his mentorship, we might not have even thought about building something like Grow with Glow. We are truly grateful for his support, wisdom, and the way he motivates us to aim higher and think deeper.

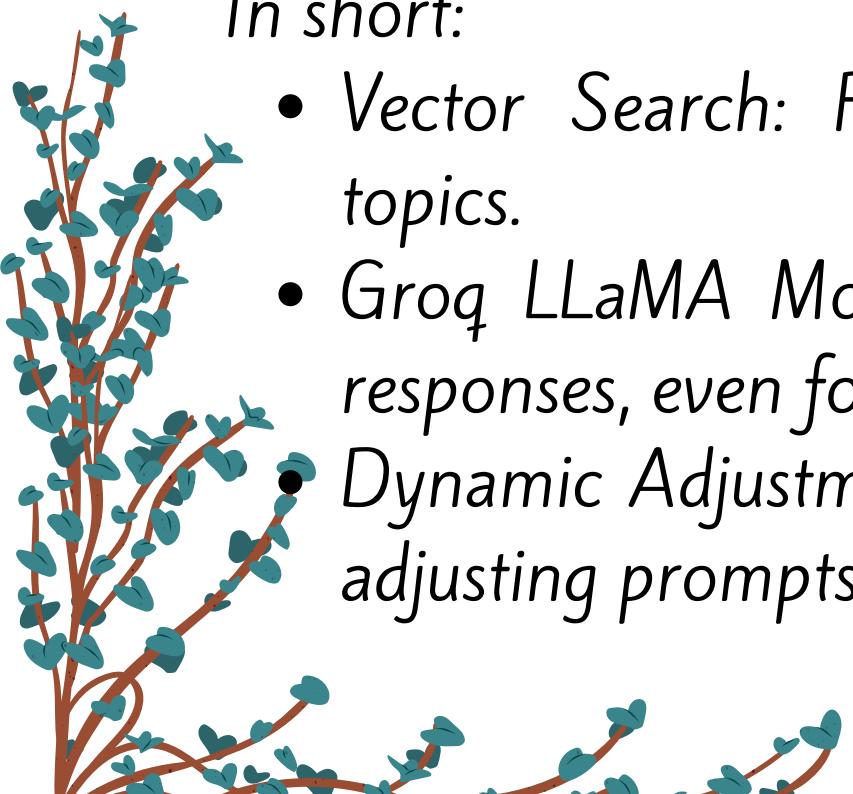
# Technical Approach

We implemented the all-MiniLM-L6-v2 transformer-based sentence embedding model to convert user questions and answers into vector representations. These vectors are indexed using FAISS, enabling fast similarity search. This allows the system to efficiently retrieve the most relevant content from the dataset based on user input.



When a query is related to specific conditions such as diabetes, the system first checks for relevant context in the indexed data. If the dataset includes relevant entries (e.g., foods suitable for diabetes), it will retrieve and use them. If not, the system leverages the general health knowledge of the LLaMA 3.3-70B model (via the Groq API) to generate a well-informed, context-aware response.

To ensure a more accurate and specialized response for medical or dietary queries, the system prompt can be dynamically adjusted when certain keywords like "diabetes", "hypertension", or "obesity" are detected in the user's query. This ensures the chatbot provides safe, general advice while focusing on region-specific options such as Goa's local crops and fruits.

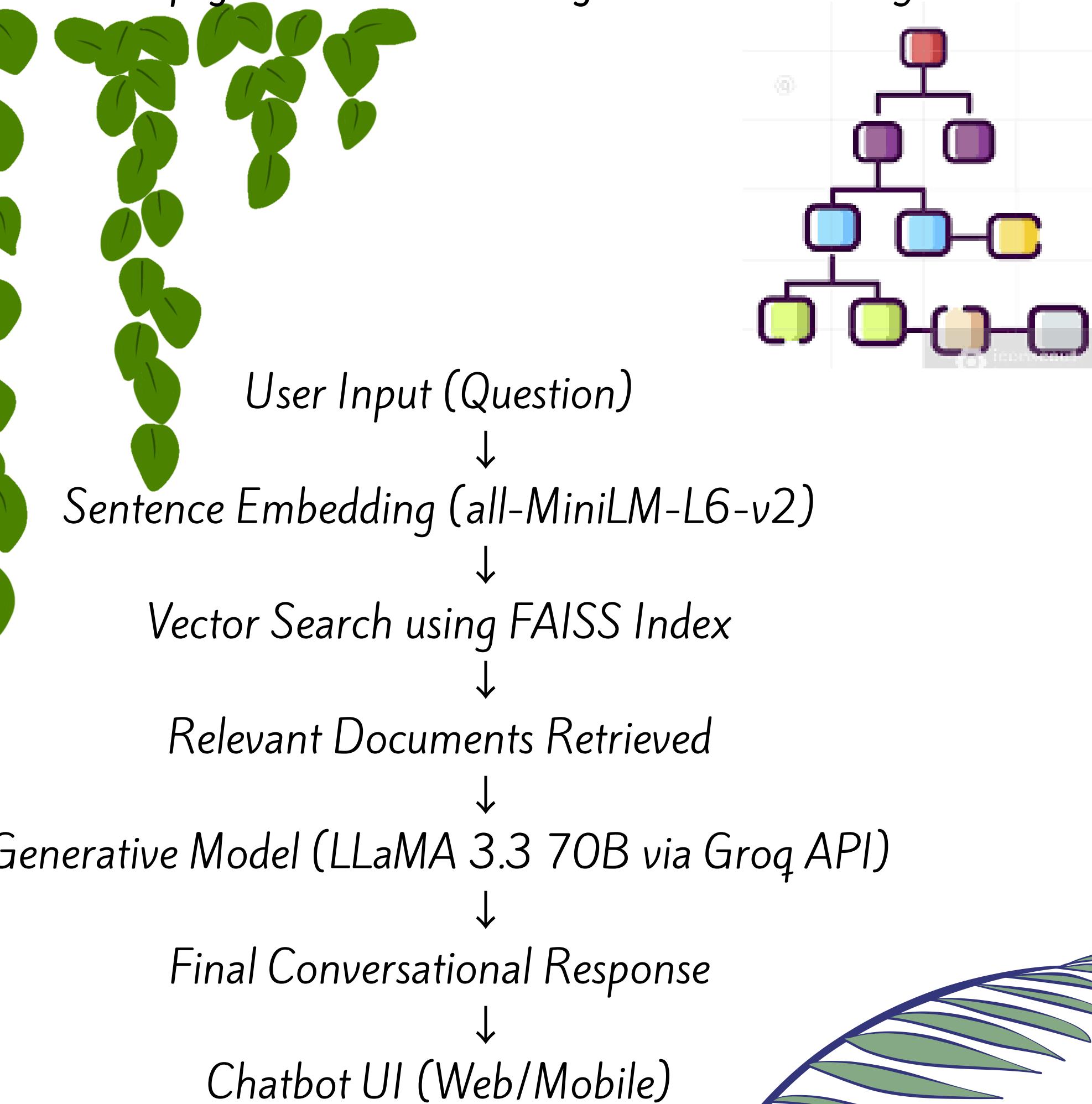


In short:

- Vector Search: Retrieves relevant context based on dietary topics.
- Groq LLaMA Model: Generates conversational, context-aware responses, even for medical queries like diabetes.
- Dynamic Adjustments: Ensures medically cautious responses by adjusting prompts when health-related queries are detected.

# System Architecture

Below is a simplified architecture of the SoilMate system :





# Tools and Technologies



Component Tool

Embedding Model

Vector Search

Language Model

Backend

Frontend

Hosting

IDE

Model Training

Framework

all-MiniLM-L6-v2 (Hugging Face)

FAISS

LLaMA 3.3 70B (via Groq API)

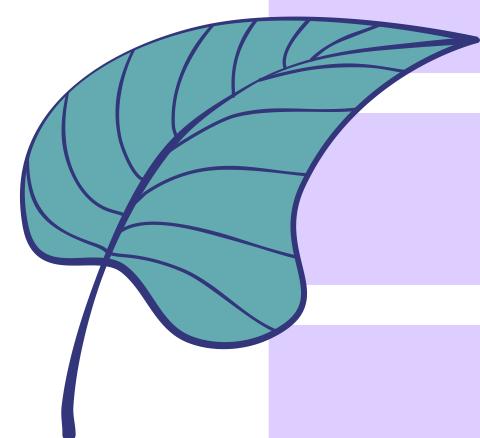
Python (FastAPI/Flask)

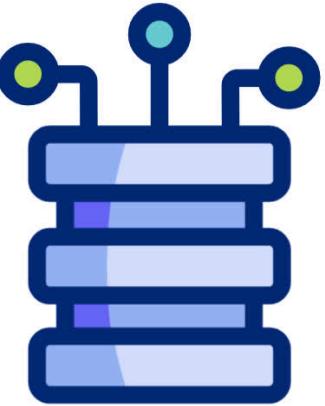
HTML, CSS, JavaScript

local server

Visual Studio Code

personal computer





# Dataset Used

To fine-tune the chatbot to Goa's agricultural needs, we created a domain-specific knowledge base, including:

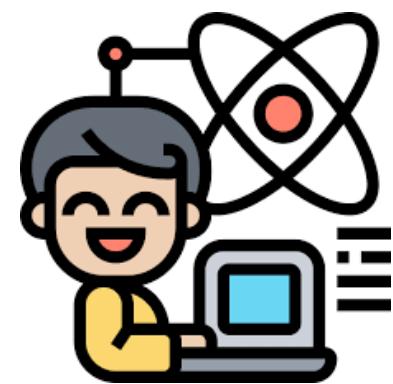


from Goa's agriculture department websites

Research articles and local guides on coastal saline farming

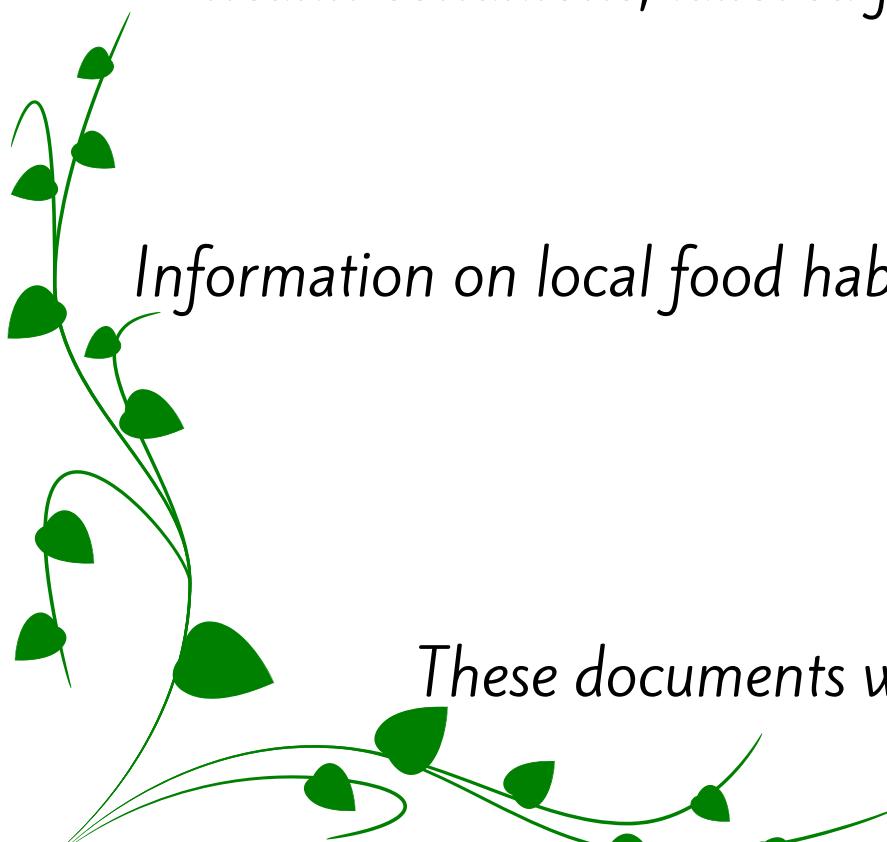


Expert-curated responses from local agronomists



Seasonal crop rotation calendars specific to the Konkan region

A collection of dietary advice related to diabetes, hypertension, and other health conditions, tailored for local fruits and vegetables



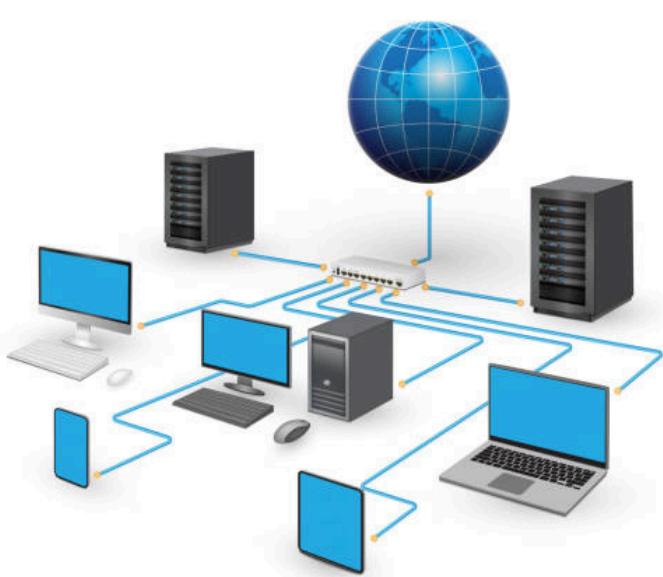
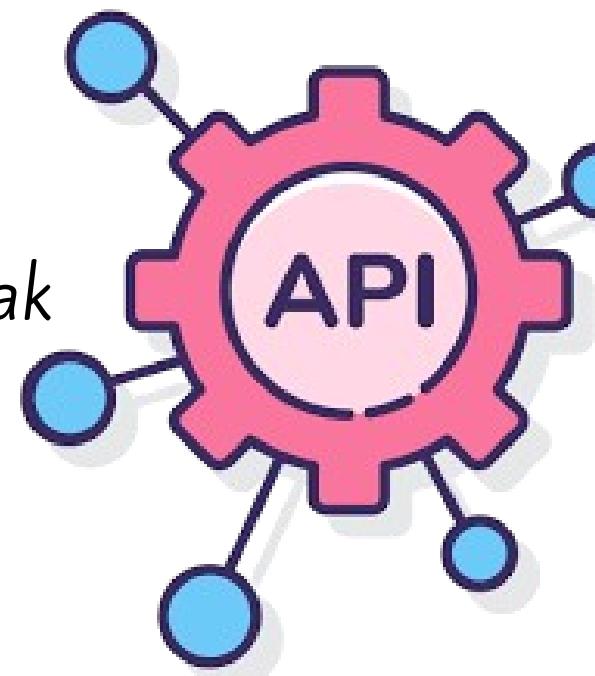
Information on local food habits, health tips, and region-specific diets for managing chronic conditions

These documents were vectorized and stored in FAISS for fast retrieval.

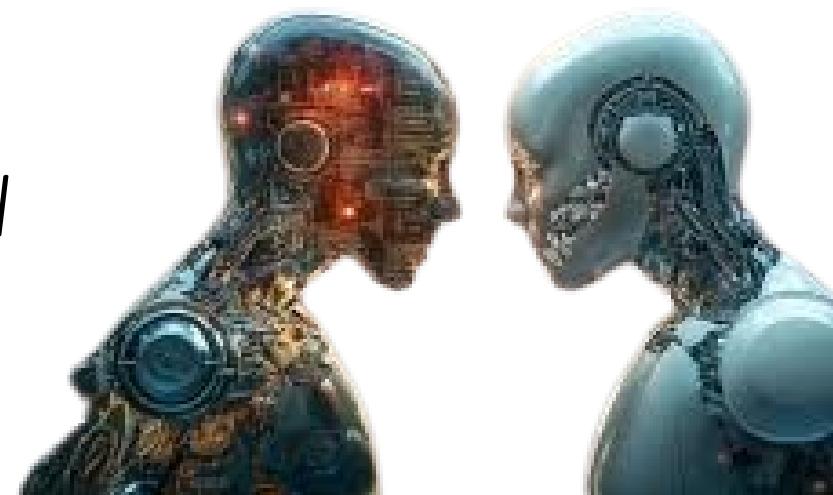


# Challenges Faced

1. Groq API Limitations: High response latency during peak hours.



2. 🌱 Data Scarcity: Local agriculture data is limited and not well-formatted.



3. ⚙️ Model Alignment: Making LLaMA model sound empathetic and beginner-friendly.

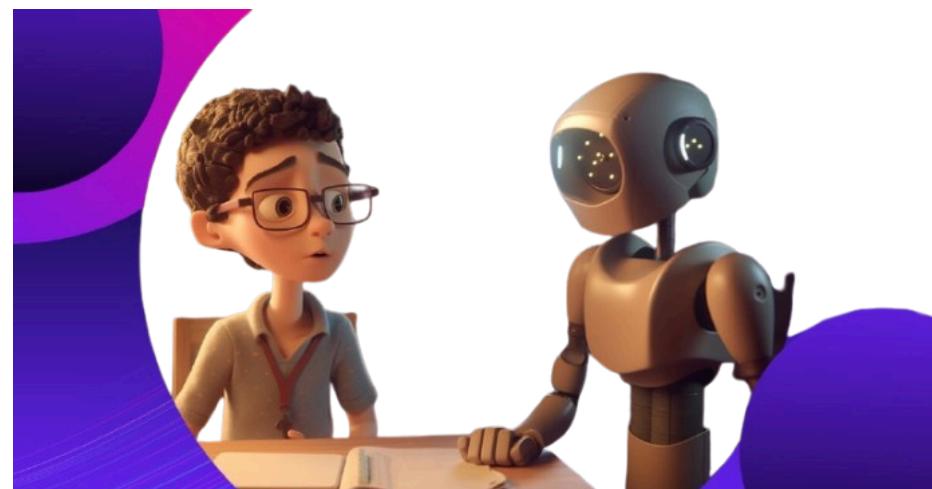


4. 📡 Connectivity: Poor internet in rural areas may affect chatbot access.

# Learnings and Impact

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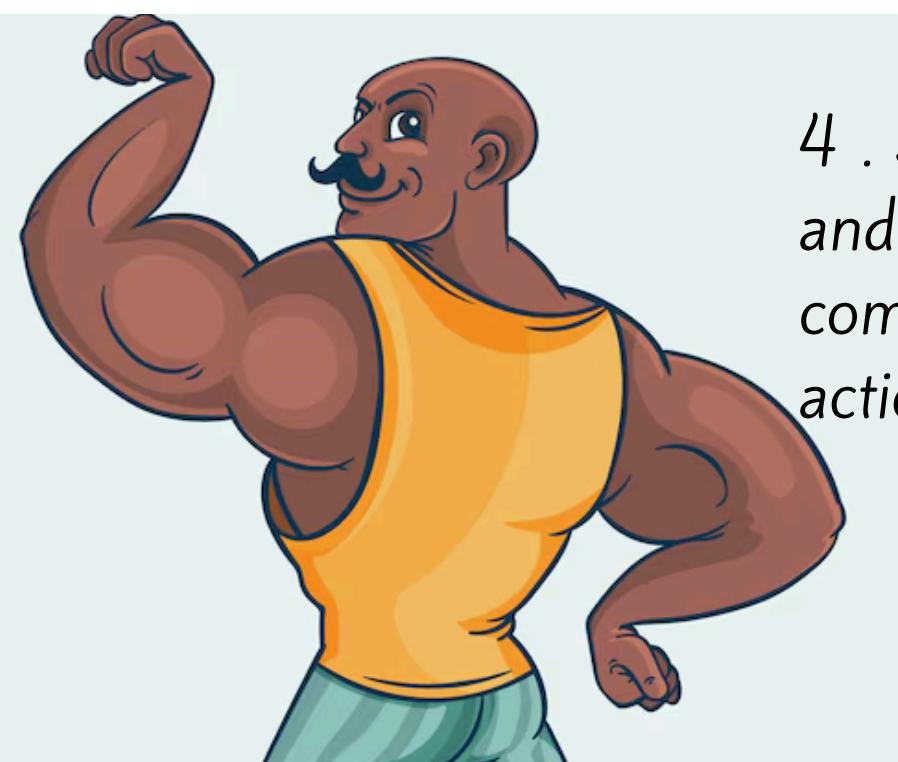
1 : Gained hands-on experience in implementing Retrieval-Augmented Generation (RAG) pipelines to enhance the chatbot's ability to provide contextually accurate responses.



2. Learned about FAISS indexing and sentence-level embeddings (such as all-MiniLM-L6-v2) to efficiently retrieve relevant data from large datasets for real-world applications.



3 . Understood how AI can be tuned for hyper-localized impact, enabling solutions specifically tailored to Goa's unique agricultural and dietary needs.



4 . Strengthened the belief that combining technology and tradition can significantly uplift rural and local communities, empowering them with personalized, actionable insights in agriculture and health.



# Evaluation and Testing



We evaluated the chatbot using both technical metrics and human feedback:

## 💡 Technical Evaluation:



Top-k Accuracy: Measures whether the correct document was among the top retrieved.

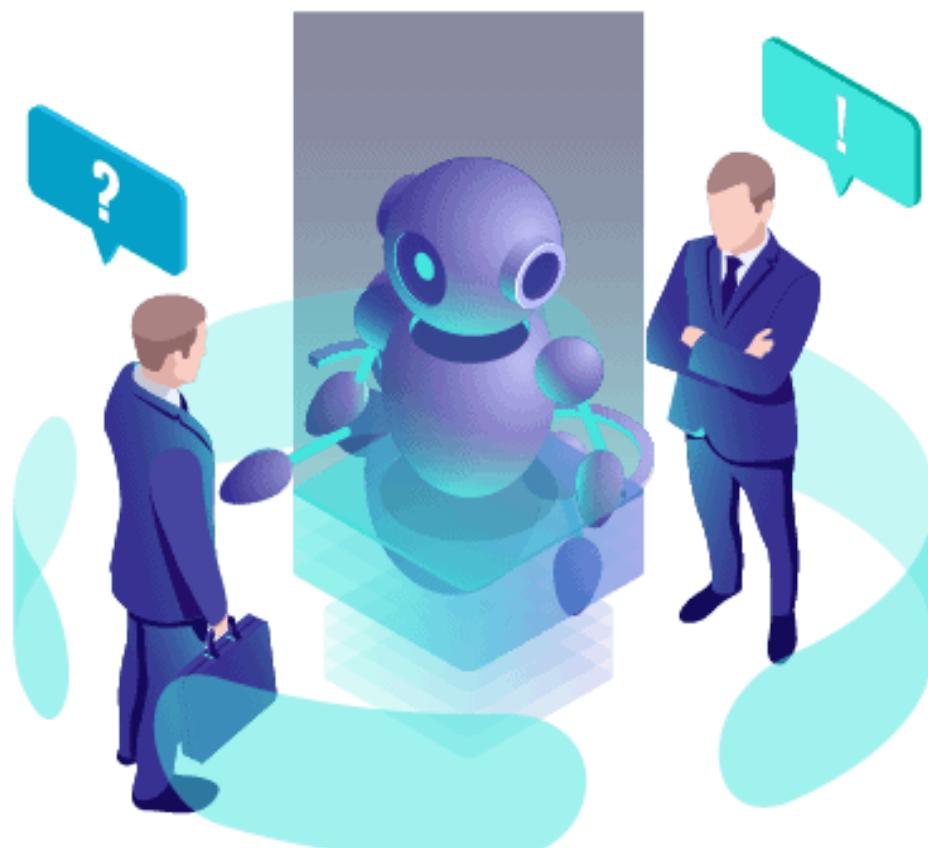
Latency: Time taken to respond after query (measured in ms).

## ❤️ Human Evaluation:

Clarity of Response

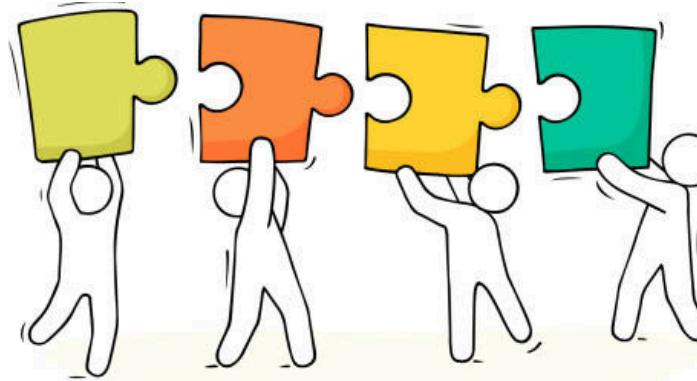
Helpfulness

Goal-Relevance



We collected feedback from 5 local farmers and 10 agriculture students. 85% rated responses as "very helpful" and "accurate to Goa's needs."

# Conclusion



Grow to Glow stands as an innovative application of AI in the field of agriculture. By merging modern AI with traditional farming knowledge, this project aims to make farming practices more efficient and accessible.



Leveraging deep learning methods such as sentence embeddings, retrieval mechanisms, and generative language models, the system offers highly personalized advice for plant cultivation tailored to Goa's unique agricultural conditions.

This approach empowers local farmers and gardeners to make more informed decisions, leading to increased productivity and sustainable farming practices.





# References



- HuggingFace MiniLM
- FAISS by Facebook AI
- Groq API Docs
- LLaMA 3.3 Overview
- Goa Agriculture Department – Research Reports



thank you

