Geography AI Tutor

RAG-based Personalized Learning System

Presenter: [Your Name]

Project: AI-Powered Geography Education System

Track: Module E - AI Applications

⚠ Problem Statement

One-Size-Fits-All Education

Traditional classroom teaching follows a uniform approach that fails to address individual learning paces, styles, and comprehension levels of students.

Limited Availability

Students lack access to immediate, personalized assistance outside classroom hours when they encounter difficulties with geography concepts.

Static Learning Resources

Traditional textbooks provide static information without the ability to clarify doubts or provide contextual explanations for specific queries.

Concept Disconnection

Students struggle to connect different geographical concepts and understand their real-world applications, leading to rote memorization.

Why This Matters

Class 10 Geography covers diverse topics from resource management to economic geography. Students need intelligent, curriculum-aligned assistance that can provide instant, contextual responses based on authoritative educational content.

Project Outcome

Complete RAG-based AI Tutor

Built a comprehensive Retrieval-Augmented Generation system that combines the NCERT Class 10 Geography textbook with advanced AI to provide personalized, contextual learning assistance.

- Semantic Search
- Natural Language Q&A
- Curriculum Aligned
- Progress Tracking
- Web Interface
- Chat History

RAG Architecture Flow

1. Student asks geography question in natural language
2. System searches FAISS vector database for relevant content
3. Retrieved textbook chunks provide context
4. Groq AI generates educational response
5. Student receives personalized, accurate answer

Live System: 823 Document Chunks • 2-3 Second Response Time • Full Web Interface

Project Objectives

Build AI-Powered Geography Tutor

Create an intelligent tutoring system that leverages RAG architecture to provide accurate, contextual responses to geography questions based on NCERT curriculum.

Ensure Curriculum Alignment

Develop a system that strictly adheres to the NCERT Class 10 Geography syllabus, providing educationally appropriate responses that enhance student learning.

Implement RAG Architecture

Successfully integrate document processing, vector database, and AI generation components to create an efficient retrieval-augmented generation system.

Create Intuitive User Experience

Design a user-friendly web interface that enables students to easily ask questions, view responses, and track their learning progress.

Key Success Metrics

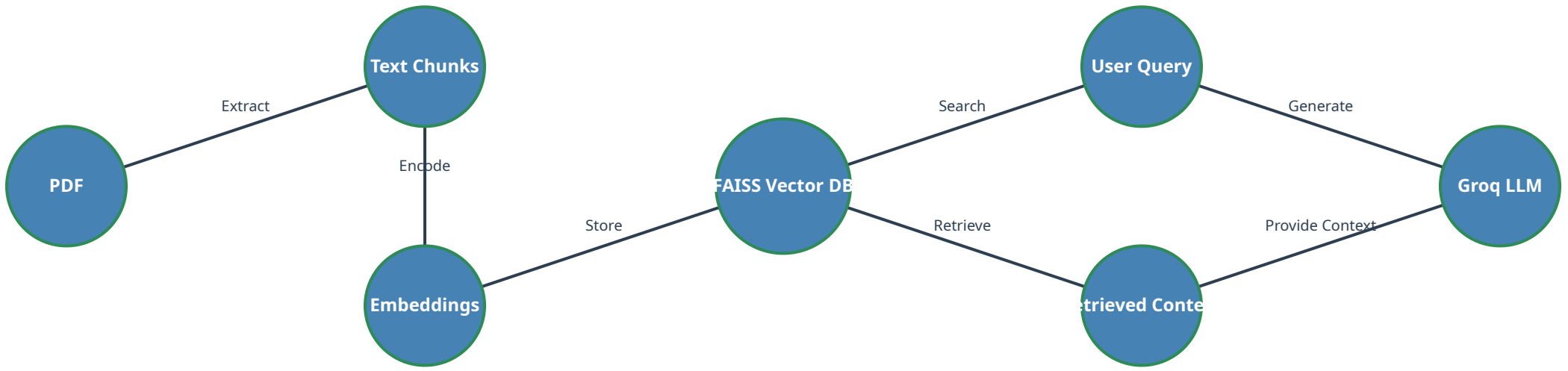
- Accurate Curriculum Coverage
- Fast Response Time (2-3s)
- Contextual Understanding
- Scalable Architecture

Methodology

Four-Phase RAG Implementation Approach

The project employed a Retrieval-Augmented Generation (RAG) architecture to create an intelligent geography tutoring system. This approach combines the knowledge from the NCERT textbook with AI generation capabilities to provide accurate, contextual responses.

RAG Architecture Flow



1 Document Processing

Extracted text from NCERT Geography PDF and split into 823 semantic chunks using LangChain's RecursiveCharacterTextSplitter

2 Vector Store Creation

Generated embeddings using Sentence Transformers and stored in FAISS vector database for efficient similarity search

3 RAG Implementation

Integrated retrieval system with Groq API to generate contextual responses based on relevant document chunks

4 UI Development

Created interactive Streamlit interface with educational features like sample questions, progress tracking, and chat history

Tools & Technologies

Core AI Framework

LangChain
Framework for building RAG pipeline, document processing, and chain orchestration

FAISS
Vector database for efficient similarity search and retrieval

Groq API
Fast LLM inference using llama-3.1-8b-instant model

Development Stack

Python 3.11
Primary programming language for backend and AI integration

Streamlit
Web framework for interactive user interface development

PyPDF
Library for PDF text extraction and processing

ML & Embeddings

Sentence Transformers
all-MiniLM-L6-v2 model for generating 384-dimensional text embeddings

NumPy & Pandas
Data manipulation and numerical operations

Hugging Face
Access to pre-trained models and transformers

Frontend Layer: Streamlit UI, Custom CSS, Interactive Components

Application Layer: RAG System, Question Processing, Response Generation

Data Layer: FAISS Vector Store, Document Chunks, Embeddings

Implementation Steps

Document Processing

- Extracted text from NCERT Geography PDF using PyPDF
- Implemented text preprocessing for consistency
- Split content into 823 semantic chunks using LangChain's RecursiveCharacterTextSplitter

Vector Store Creation

- Generated 384-dimensional embeddings using Sentence Transformers
- Built FAISS vector database for efficient similarity search
- Implemented vector store persistence for reusability

RAG System Integration

- Integrated Groq API with llama-3.1-8b-instant model
- Developed query processing and context generation
- Created educational prompt templates for geography tutoring

Web Interface Development

- Built interactive Streamlit application with educational theme
- Implemented sample questions, progress tracking, and chat history
- Added error handling and user feedback mechanisms

Final Milestone: Complete RAG System with 823 Document Chunks and Web Interface

Demo & Key Features

Interactive Q&A Interface

Geography AI Tutor

Q: What are renewable resources and give examples?

A: Renewable resources are natural resources that can be replenished over time. Examples include solar energy, wind energy, water (hydro power), forests, and biomass. These resources are sustainable as they can be naturally restored within a human lifetime.

Ask Another Question

Natural language question answering with contextual responses based on NCERT textbook content. Students can ask any geography question and receive educational, curriculum-aligned answers.

Average response time: 2-3 seconds with high accuracy

Sample Questions & Topics

Topics & Sample Questions

Topics Covered:

- Resources and Development
- Forest and Wildlife Resources
- Water Resources
- Agriculture
- Minerals and Energy Resources
- Manufacturing Industries

Sample Questions:

- What are renewable resources?
- Explain the importance of forests
- What is sustainable development?
- Types of agriculture in India

Pre-defined sample questions and comprehensive topic coverage guide students through the curriculum. The sidebar provides easy access to key geography topics from the NCERT Class 10 syllabus.

Complete coverage of all NCERT Class 10 Geography chapters

Progress Tracking

Learning Progress

Quick Stats Last Updated: Now

12	6	✓
Questions Asked	Topics Covered	Vector Store

Recent Questions:

- What are renewable resources?
- Explain the importance of forests
- What factors affect agriculture in India?

Track learning progress with statistics on questions asked, topics covered, and recent interactions. The system maintains a history of all questions and responses for review.

Complete chat history for continuous learning

Semantic Search & RAG

Behind the Scenes

RAG System Status ✓ Active

Query:
"What are the different types of soil in India?"

Retrieved Context:
- Chapter 1: Resources and Development
- Section: Soils in India
- 5 relevant chunks retrieved from vector store
- 823 total document chunks available

Powerful semantic search retrieves the most relevant content from the NCERT textbook. The RAG system combines retrieval with AI generation for accurate, contextual responses.

FAISS vector database with 823 document chunks

Live Demo Available at: https://8501-ijj229fpswpmpn1bqxxzr-f8b96c74.manusvm.computer