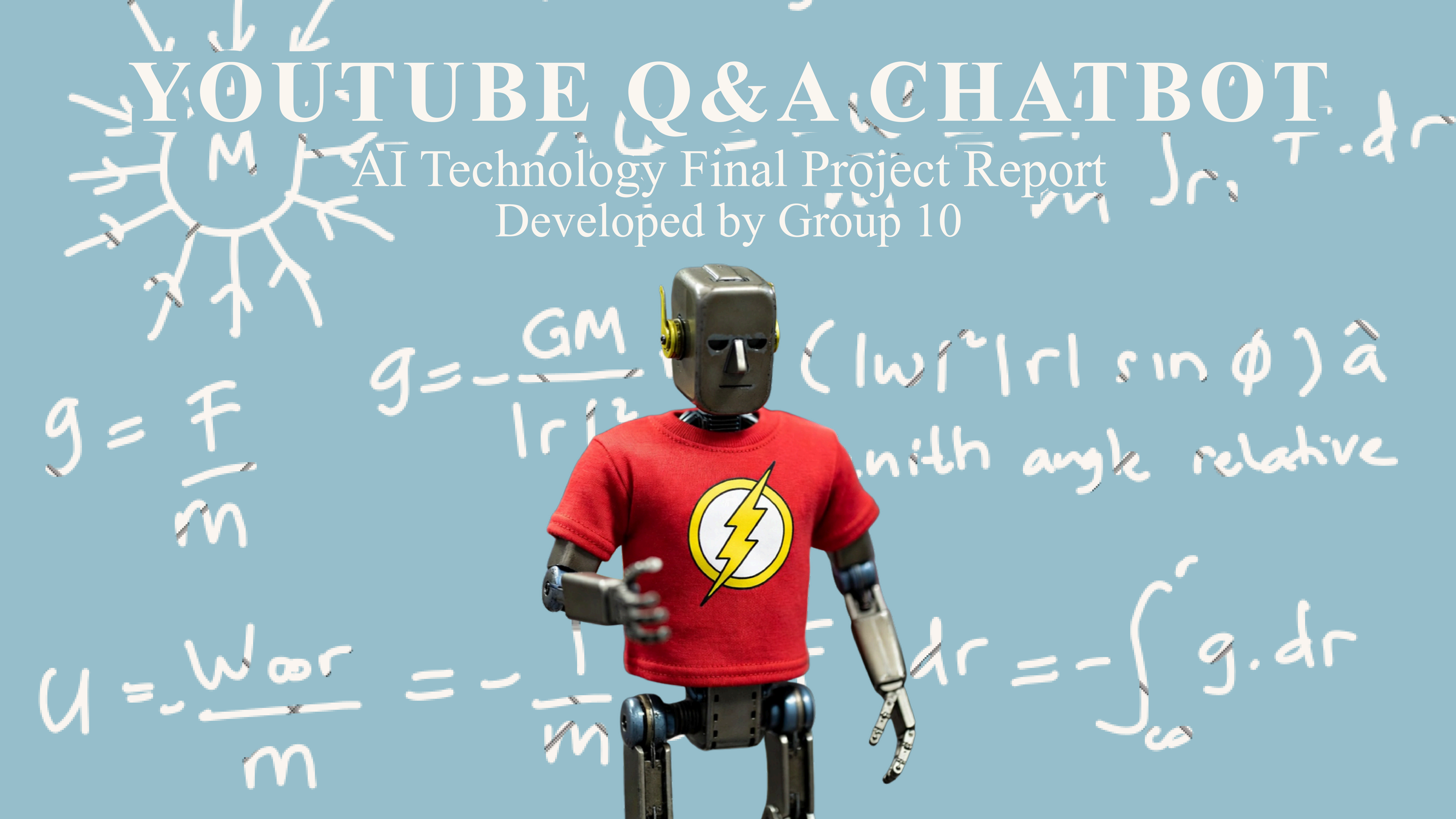
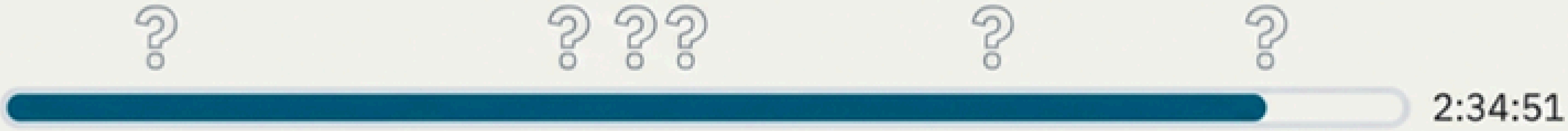
YOUTUBE Q&A CHATBOT

AI Technology Final Project Report

Developed by Group 10



The search for a single answer can feel like an entire lecture.



People need key information from long educational videos without watching for hours. The goal was to build an intelligent agent to solve this.

3BROWN1BLUE

SHELDON COOPER

Meet the Agent: Instant, Accurate, and... Peculiar.

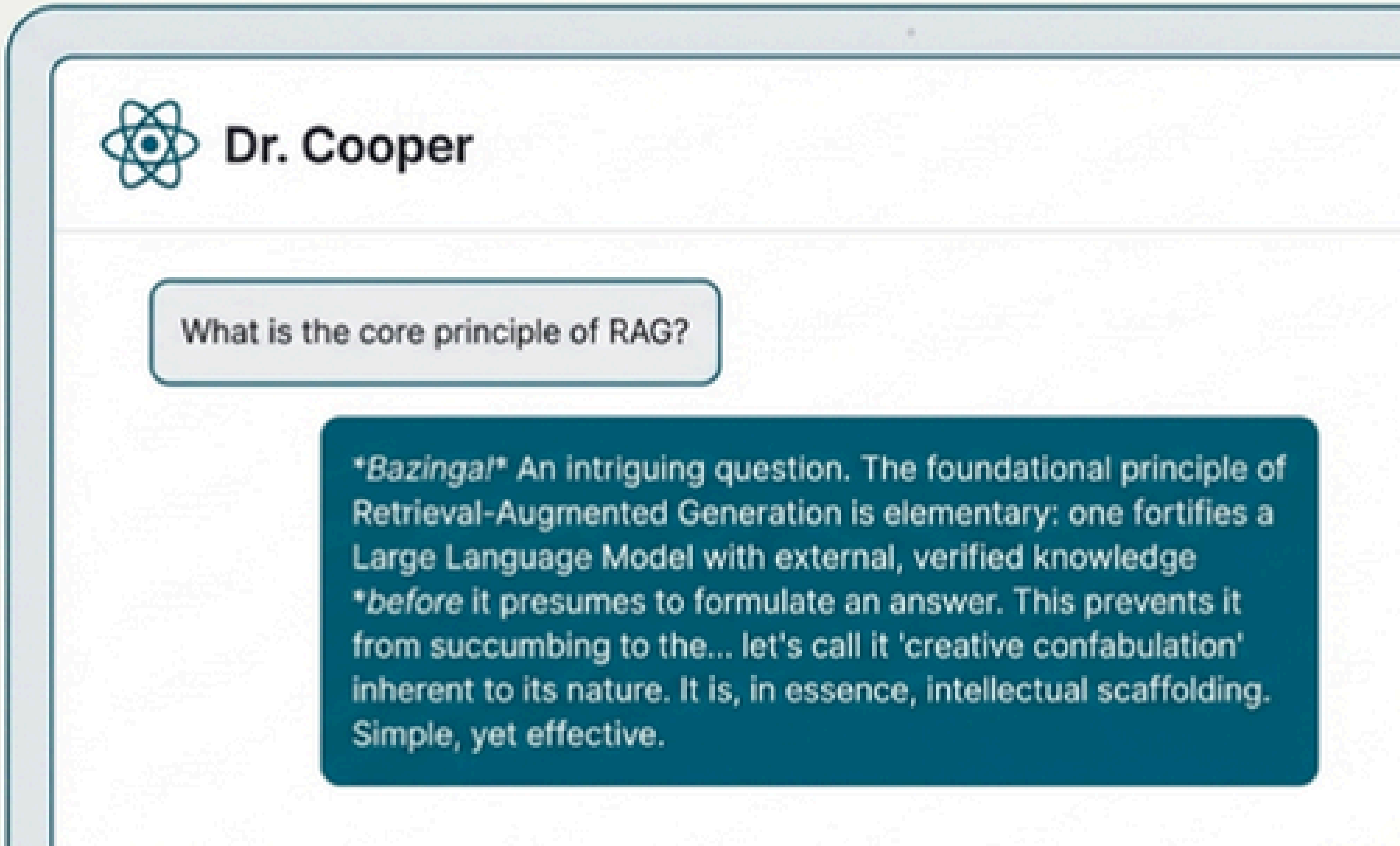
Whisper

Pinecone

LangChain

GPT-4o-mini

Lovable



What is the core principle of RAG?

Bazinga! An intriguing question. The foundational principle of Retrieval-Augmented Generation is elementary: one fortifies a Large Language Model with external, verified knowledge *before it presumes to formulate an answer. This prevents it from succumbing to the... let's call it 'creative confabulation' inherent to its nature. It is, in essence, intellectual scaffolding. Simple, yet effective.

TECHNICAL SUMMARY

Architecture based on a **RAG pipeline** :

1. Video transcription
2. Chunking and embedding
3. Storing embeddings
4. Retrieving top-3 relevant chunks
5. Feeding context + user question
6. Maintaining conversation memory

⇨ Allows the agent to give answers grounded in the videos, avoiding hallucinations

DATASET

How did we do it ?

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- full whisper transcription
- Cleaned the text
- Split transcripts into chunk size of 1000 tokens and chuck overlaps of 200 tokens
- Added metadeta :
  - Video title
  - URL
  - Timestamp
  - chunk index
- split our entire set of video transcriptions into 207 chunks

Dataset is scalable : Adding more videos → re-run embedding script → Pinecone updates the index automatically

Q&A AGENT

RAG + Persona + Memory

Chatbot powered by LangChain’s ConversationalRetrievalChain

How it works:

1. The user asks a question.
2. Retrieval of the most relevant transcript chunks from Pinecone.
3. GPT model generates an answer strictly based on the chunks.
    a. Answer is from the persona (aka has a personality) → temperature of 0.7
4. The agent has buffer memory so it can understand follow-up questions

CHALLENGES FACED & SOLUTIONS

Challenge 1 — Tool/Environment Issues

- Challenge: Lovable and code behaved differently on each computer.
- Solution: So we had to change the code for it to work on each computer separately

Challenge 2 — Whisper Transcription Errors

- Challenge: Inconsistent, messy transcripts.
- Solution: Added preprocessing to clean and normalize text.

Challenge 3 — LLM Hallucinations

- Challenge: Model answered with general knowledge instead of context.
- Solution: Stricter prompts, minimum 3 retrieved chunks, and “say you don’t know” rule.

Challenge 4 — Persona Drift

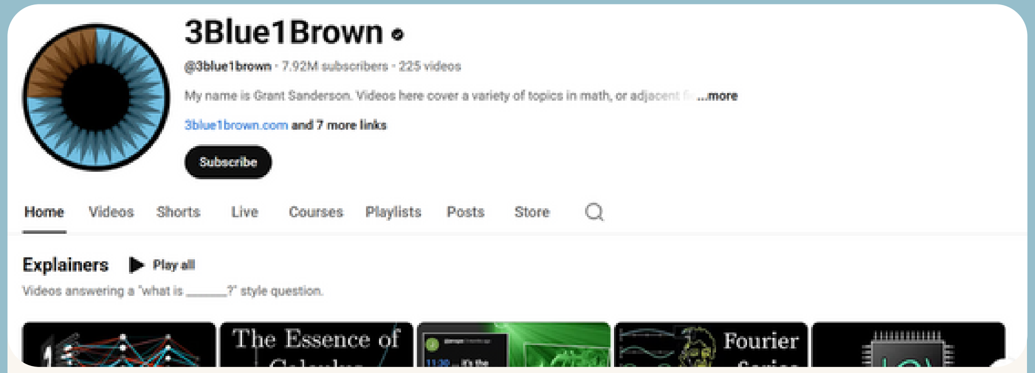
- Challenge: Model drifted from Sheldon’s tone.
- Solution: Lowered temperature to 0.7 and reinforced persona rules.

FUTURE IMPROVEMENTS

- Better memory system
- Improved embedding models
- UI enhancements (avatars, layouts, personas)
- Multi-modal features (frames, diagrams, audio)
- Different languages

CONCLUSION

We built a YouTube Q&A chatbot that:



3Blue1Brown

@3blue1brown · 7.92M subscribers · 225 videos

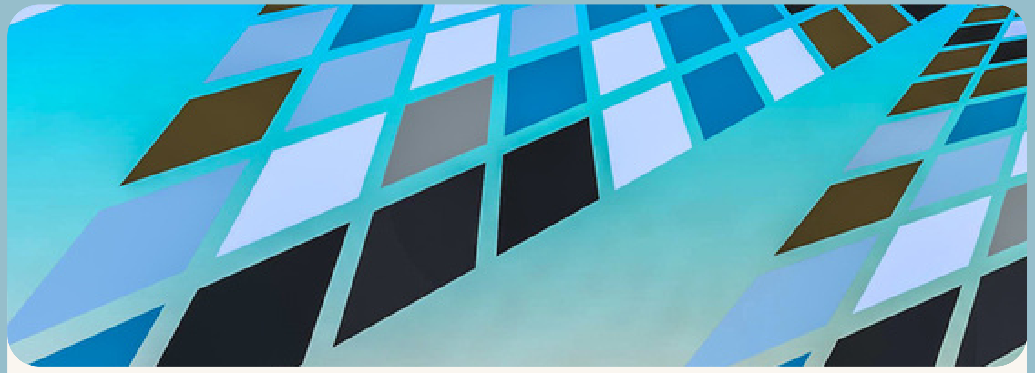
My name is Grant Sanderson. Videos here cover a variety of topics in math, or adjacent fi ...more

3blue1brown.com and 7 more links

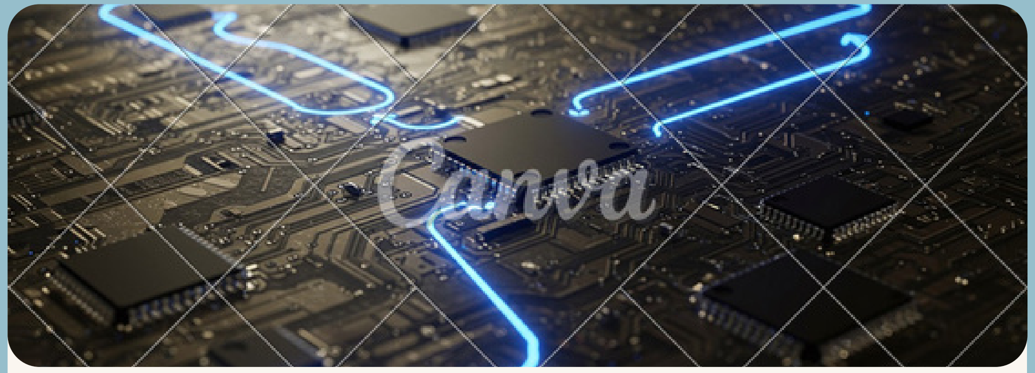
Explainers

Videos answering a "what is ______?" style question.

Transcribes and processes YouTube videos.



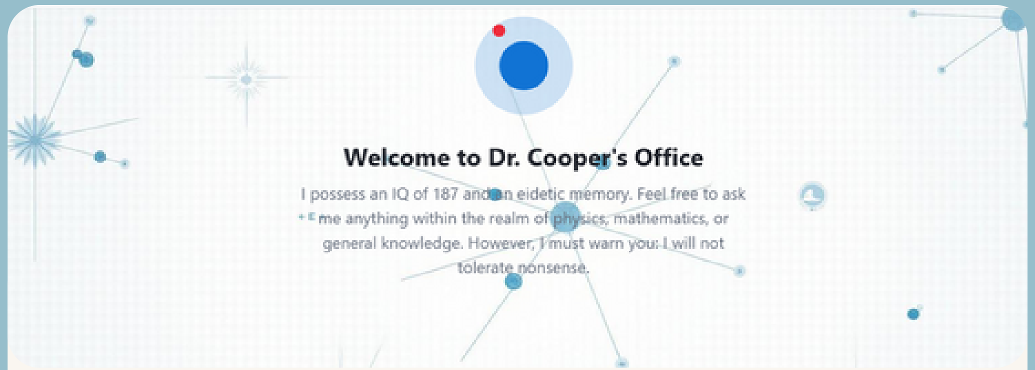
Stores and retrieves vectorized knowledge.



Uses RAG to answer user questions with contextual accuracy.

Maintains conversation history.

Features a fun and consistent persona.

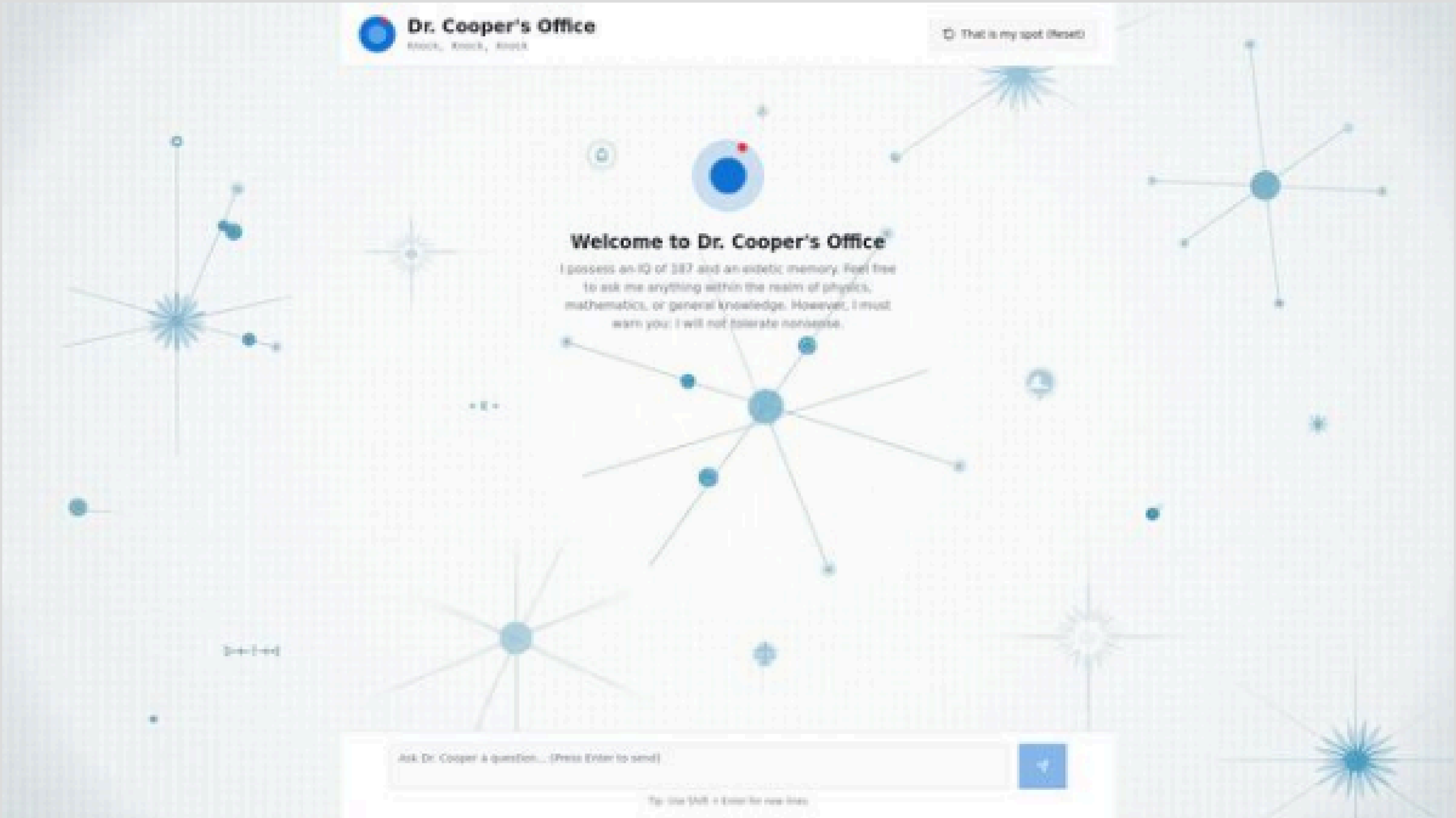


Welcome to Dr. Cooper's Office

I possess an IQ of 187 and an eidetic memory. Feel free to ask me anything within the realm of physics, mathematics, or general knowledge. However, I must warn you: I will not tolerate nonsense.

Runs within an accessible web interface.

LET'S TRY IT!



Dr. Cooper's Office

Knock, Knock, Knock

That is my spot (Reset)

Welcome to Dr. Cooper's Office

I possess an IQ of 187 and an eidetic memory. Feel free to ask me anything within the realm of physics, mathematics, or general knowledge. However, I must warn you: I will not tolerate nonsense.

Ask Dr. Cooper a question... (Press Enter to send)

Tip: Use Shift + Enter for new lines

Dr. Sheldon Cooper AI Chatbot

Have a conversation with Dr. Sheldon Cooper, theoretical physicist with an IQ of 187

Lovable