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AI for Bharat Hackathon

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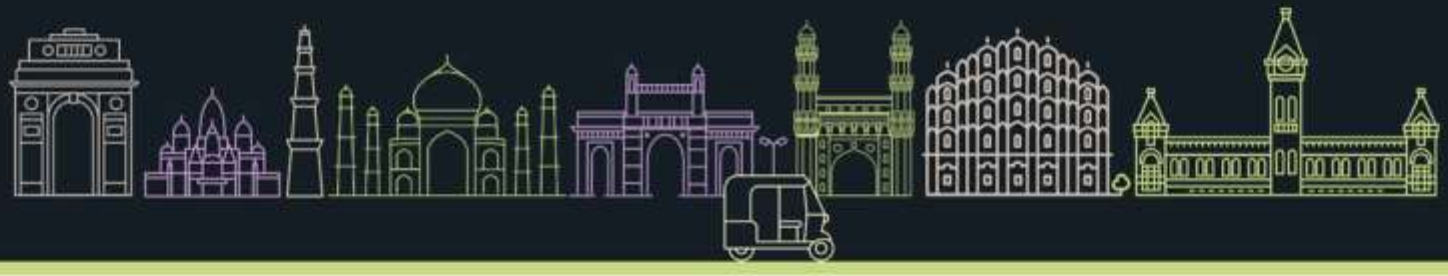

Team Name : MedResearch AI

Team Leader Name : Hackathon Participant

Problem Statement : 02 - AI for Healthcare & Life Sciences

Brief about the Idea:

MedResearch AI is a conversational AI chatbot built for researchers and scientists in the healthcare and life sciences domain. It helps them cut through the overwhelming volume of medical literature and clinical data by providing instant, cited, and grounded answers.

Researchers today spend nearly 50% of their time reading and summarizing literature instead of doing actual research. MedResearch AI solves this by letting scientists simply ask questions in plain language and get structured, source-backed responses drawn from PubMed, ClinicalTrials.gov, FDA databases, and WHO datasets.

The solution uses a RAG (Retrieval Augmented Generation) pipeline powered by Claude AI (Anthropic) to ensure every response is accurate, grounded, and accompanied by citations — making it a responsible AI tool for the healthcare ecosystem.

What Makes MedResearch AI Different?

- Unlike generic AI chatbots, MedResearch AI is domain-specialized — every response is grounded in publicly available medical databases (PubMed, ClinicalTrials.gov, FDA) using RAG, with mandatory citations. No hallucinations, no unsourced claims.
- It solves the core problem of research inefficiency: instead of reading 50 papers, a scientist can ask “What are the latest Phase 3 trial results for Drug X in Type 2 Diabetes?” and get a structured, cited answer in seconds — accelerating the path from research to patient care.
- USP: The only conversational research assistant that combines multi-source RAG retrieval + hallucination prevention + structured documentation export + regulatory

Key Features of MedResearch AI

- Conversational Chat Interface — Ask questions in plain English, get structured medical research answers instantly
- Clinical Trial & Research Summarization — Summarize multi-page papers and trial results in seconds
- Drug Efficacy Comparison — Compare treatment outcomes across multiple published studies side-by-side
- Regulatory & Compliance Navigation — Navigate FDA, EMA, ICH, and WHO guidelines through natural language queries
- Cited Responses — Every answer includes source citations (PubMed IDs, trial IDs, FDA links) — no unsourced claims
- Export Reports — Export full research summaries and conversation history as PDF or Markdown
- Hallucination Prevention — Responses grounded strictly in retrieved data; AI clearly flags uncertainty and limitations

Process Flow: How MedResearch AI Works

① Researcher enters a natural language query (e.g. “Summarize Phase 3 trials for Drug X in oncology”)

② Query is embedded and semantically matched against the vector database (PubMed, ClinicalTrials.gov, FDA data)

③ Top relevant document chunks are retrieved and passed as context to Claude AI (RAG pipeline)

④ Claude AI generates a structured, grounded response with source citations attached to every claim

⑤ Researcher views response in chat, can ask follow-up questions, then export as PDF or Markdown report

UI Wireframe: Key Screens of MedResearch AI

- **Screen 1 — Login & Onboarding:** Secure sign-in, role selection (Researcher / Scientist), and data disclaimer acknowledgment
- **Screen 2 — Main Chat Interface:** Left sidebar (query history), central chat window, right panel showing retrieved source documents
- **Screen 3 — Source Panel:** Expandable citation cards showing PubMed ID, trial number, FDA document links alongside each AI response
- **Screen 4 — Export Screen:** One-click export of complete session as a structured research report in PDF or Markdown format

Architecture of MedResearch AI

Layer 1 — Frontend: React.js + Tailwind CSS chat interface → Auth0 authentication

Layer 2 — API Gateway: Python FastAPI (REST) with JWT auth, rate limiting, session management

Layer 3 — AI Orchestration: LangChain orchestrates the RAG pipeline → Claude AI (claude-sonnet-4-5) generates grounded responses

Layer 4 — Vector DB: Pinecone / ChromaDB stores embeddings of indexed medical literature for semantic retrieval

Layer 5 — Data Sources (Public Only): PubMed API, ClinicalTrials.gov API, FDA Drug Database, WHO Datasets, bioRxiv/medRxiv

Layer 6 — Deployment: AWS / GCP with Docker + Kubernetes, CI/CD via GitHub Actions, monitoring via LangSmith + CloudWatch

Technologies Used in MedResearch AI

- **AI Model:** Claude AI by Anthropic (claude-sonnet-4-5-20250929) — for grounded, safe, and responsible generation
- **RAG Framework:** LangChain — for orchestrating retrieval, context injection, and prompt management
- **Vector Database:** Pinecone / ChromaDB — for semantic similarity search across embedded medical documents
- **Backend:** Python FastAPI — high-performance async API with JWT authentication and rate limiting
- **Frontend:** React.js + Tailwind CSS — responsive, accessible chat UI (WCAG 2.1 compliant)
- **Cloud & DevOps:** AWS / GCP, Docker, Kubernetes, GitHub Actions (CI/CD), Terraform (IaC), LangSmith (LLM monitoring)

Estimated Implementation Cost

- **Claude API (Anthropic):** ~$50-150/month for prototype usage (pay-per-token model)
- **Vector DB (Pinecone):** Free tier for prototype; ~$70/month for production (1M vectors)
- **Cloud Infrastructure (AWS/GCP):** ~$100-200/month for compute, storage, and networking (small-scale deployment)
- **Data Sources:** Free (PubMed API, ClinicalTrials.gov API, FDA Open Data, WHO — all publicly available at no cost)
- **Total Estimated MVP Cost:** ~$250-450/month | One-time dev setup: ~$2,000-5,000 (open-source stack minimizes cost)

Responsible AI Statement & Limitations

- **Data Policy:** Uses only publicly available or synthetic data — no real patient data, no PII, HIPAA-aware design
- **Accuracy & Transparency:** All responses include source citations; AI clearly indicates confidence level and flags uncertainty
- **Not a Medical Device:** MedResearch AI is a research support tool — NOT a substitute for professional medical or regulatory advice
- **Human-in-the-Loop:** All critical research decisions must be reviewed and validated by qualified healthcare professionals
- **Known Limitation:** Knowledge limited to indexed public sources; may not reflect the latest unpublished research or paywalled journals

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Thank You