MediVault — GenAI-Powered Personal Health Record Vault

Next-Generation GenAI Solution — Healthcare Domain

Problem Statement

Healthcare data is highly fragmented. Patients' medical records are distributed across hospitals, clinics, diagnostic labs, and wearable devices. Most records are difficult to interpret due to medical jargon, unstructured formats (PDFs, scanned documents), and limited interoperability between systems.

As a result:
- Patients struggle to understand their own medical history.
- Caregivers lack a unified view to manage chronic conditions.
- Clinicians spend time re-reading records and requesting missing documents.
- Emergency responders often lack immediate access to critical health history.

Impacted stakeholders include patients, caregivers, clinicians, and emergency responders.

Motivation

Fragmented healthcare information leads to repeated tests, increased costs, missed follow-ups, medication errors, and delays during emergencies.

Generative AI enables summarization of long documents, translation of complex terminology into simple language, contextual question answering, and personalized insights while maintaining privacy.

There is currently no widely adopted, patient-owned, conversational AI system for personal medical history. This creates an opportunity to build an intelligent, privacy-first medical vault.

Application

MediVault allows users to upload or connect medical reports, discharge summaries, prescriptions, lab results, and wearable data.

Users can ask natural-language questions such as:
- "Summarize my diabetes-related visits in the last 6 months."
- "What medications am I currently on?"
- "Explain my latest blood test in simple terms."

Core features include:
- Conversational health Q&A with citations
- Plain-language summaries
- Health notifications and monitoring
- Doctor and hospital recommendations
- Dual-view interface (Self Profile and Emergency/Hospital View)

Target users include chronic condition patients, elderly patients, caregivers, and emergency providers.

Proposed Method

1. Document Ingestion:
   - Accept PDFs, images, FHIR/HL7 formats
   - OCR for scanned documents
   - Text chunking for long reports

2. Retrieval-Augmented Generation (RAG):
   - Generate embeddings for document chunks
   - Store in vector database
   - Hybrid semantic + keyword search
   - Retrieve relevant context per query

3. LLM Layer:
   - Summarization
   - Contextual Q&A with citations
   - Plain-language explanations
   - Personalized insights
   - Built-in safeguards and medical disclaimers

4. Privacy-First Architecture:
   - Optional local/private-cloud deployment
   - End-to-end encryption
   - User-controlled access
   - Secure emergency access

Datasets / Data Source

Primary Data:
- User-uploaded medical documents (with consent)
- Wearable data integrations

Development & Evaluation Data:
• Synthetic medical records for testing
• Public benchmark datasets (evaluation only)

Optional Medical Ontologies:
• SNOMED
• RxNorm
• UMLS subsets

User data remains user-owned and is not used for model training.

Experiments

1. Retrieval Evaluation:
   • Mean Reciprocal Rank (MRR)
   • Recall@k
   • Precision@k

2. Generation Evaluation:
   • Faithfulness
   • Citation accuracy
   • Relevance scoring
   • Safety validation

3. Human Evaluation:
   • Clinician review
   • User feedback

4. System Metrics:
   • Latency per query
   • Cost per query
   • Scalability under load

Novelty and Scope to Scale

Novelty:
• Patient-owned encrypted vault
• Conversational GenAI over personal medical history
• Retrieval-Augmented Generation with citations
• Privacy-by-design (no training on user data)
• Emergency-access layer

• Optional insurance-document intelligence as an extension layer

Scope to Scale:
• Medication reminders
• Pre-visit AI briefs
• Predictive health alerts
• Clinic-level and employer-level vault expansion
• Partnerships with EHR vendors and hospitals