**AI-Powered Clinical Decision Support System Using Retrieval-Augmented Generation (RAG)**

# 1. Project Overview

**AI-powered clinical Decision Support System Using Retrieval-Augmented Generation (RAG)** can serve as an intermediary for patient queries to create a healthcare chatbot that can answer questions or suggest a diagnosis, offering accessible information on symptoms, medications, and treatment options sourced from a database of medical knowledge. This can improve patient engagement and enhance the decisions made by the health professionals.

**Specific Goal of the Project**

This project aims to develop an AI-powered Clinical Decision Support System (CDSS) using Retrieval-Augmented Generation (RAG) to assist doctors and healthcare professionals in making accurate, evidence-based medical decisions. The system will:

- Retrieve relevant patient records and medical literature from MIMIC-III,

- Generate reliable, context-aware clinical recommendations based on up-to-date medical knowledge.

- Reduce misdiagnoses and improve patient outcomes by providing real-time, AI-assisted decision support.

# 2. Relevance to Sustainable Development Goals (SDGs):

This project aligns with the United Nations Sustainable Development Goals (SDGs), particularly **SDG 3 (Good Health and Well-being),** also contributes to **SDG 4 (Quality Education):** By providing AI-driven medical insights for continuous learning and **SDG 1 (No Poverty):** By optimizing healthcare efficiency and reducing costs associated with incorrect treatments.

# 3. Literature Examples:

**MedRAG** enhances clinical decision support by integrating a hierarchical diagnostic knowledge graph with retrieval-augmented generation, improving diagnostic accuracy by dynamically incorporating relevant electronic health records (EHRs) and reducing misdiagnosis rates (arxiv.org). Similarly, **ClinicalRAG** addresses hallucinations in large language models (LLMs) by retrieving heterogeneous medical knowledge, ensuring more reliable and contextually accurate clinical recommendations. By extracting key medical entities and incorporating relevant knowledge during text generation, ClinicalRAG outperforms traditional models in providing trustworthy decision support for healthcare professionals (aclanthology.org). Both projects highlight the transformative potential of RAG-based models in improving diagnostic precision and mitigating misinformation in healthcare applications.

# 4. Describe Your Data:

MIMIC-III is a hybrid, multi-source dataset that's particularly valuable for building AI and ML applications in healthcare. By combining ICU patient histories with textbook standards, Wikipedia's general knowledge, and PubMed's specialized research insights, MIMIC-III allows researchers to build robust models that can simulate complex, real-world scenarios in medical diagnostics and treatment. It's widely used in medical informatics to advance areas such as predictive modeling, automated diagnostics, and clinical decision support systems.

# 5. Approach (Machine Learning or Deep Learning):

For this project, a **deep learning approach** will be used, specifically a **Retrieval-Augmented Generation (RAG) solution using TensorFlow, Keras, Hugging Face, LangChain,** and **FAISS.** RAG enhances **large language models (LLMs) by retrieving real-time medical knowledge**, reducing hallucinations, and improving response accuracy.