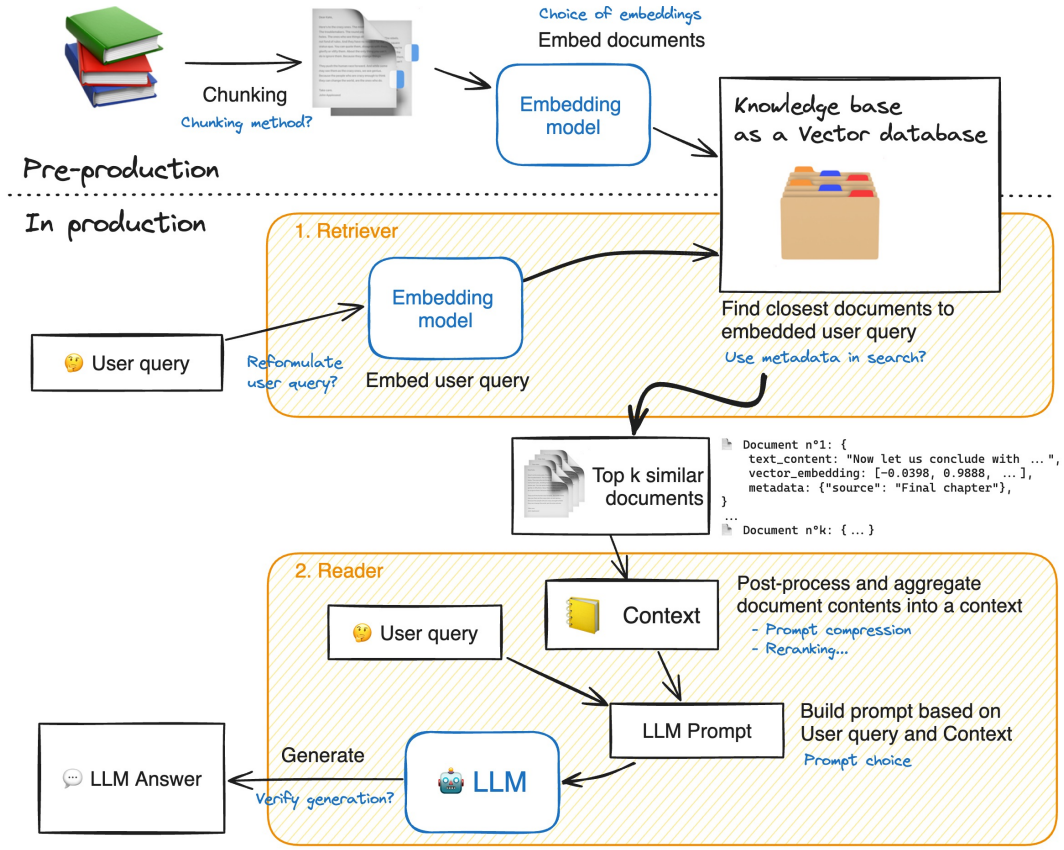
Offline Voice Based Retrieval Augmented Generation

- Retrieval Augmented Generation (RAG)
- Offline Voice Based RAG Architecture
  - Wake word Classifier
  - Automatic Speech Recognition
  - Vector database
  - Large Language Model
  - Text to Speech

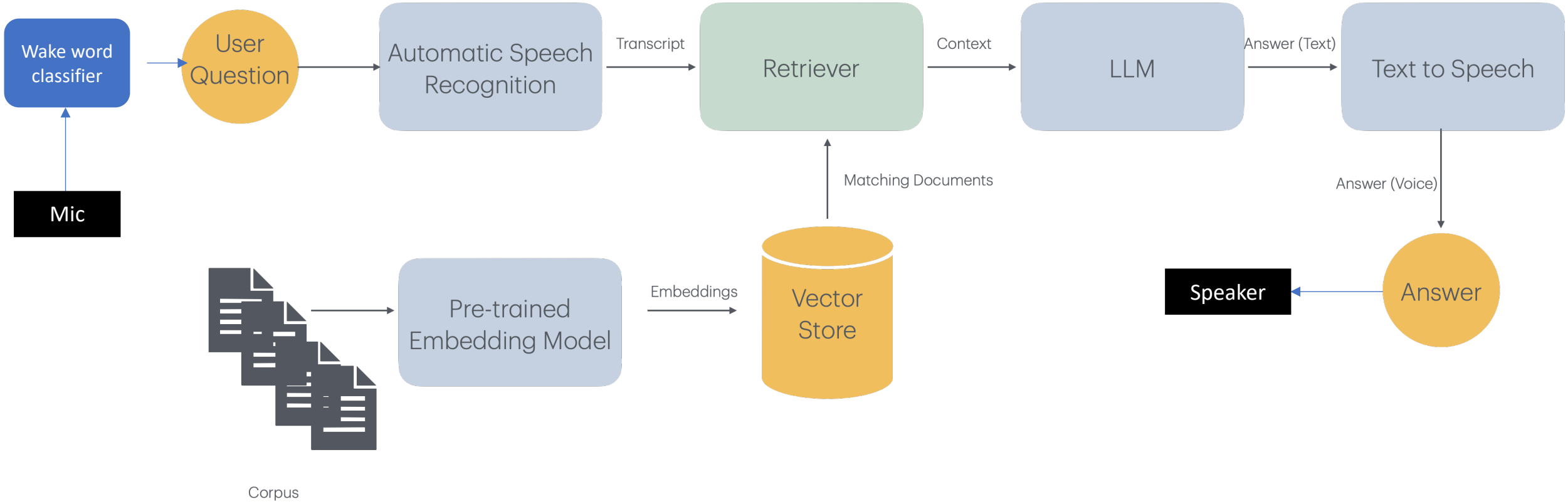
Retrieval Augmented Generation

- The concept of RAG was originally proposed as a way to provide additional context information to Large Language Models to generate more specific and accurate responses.



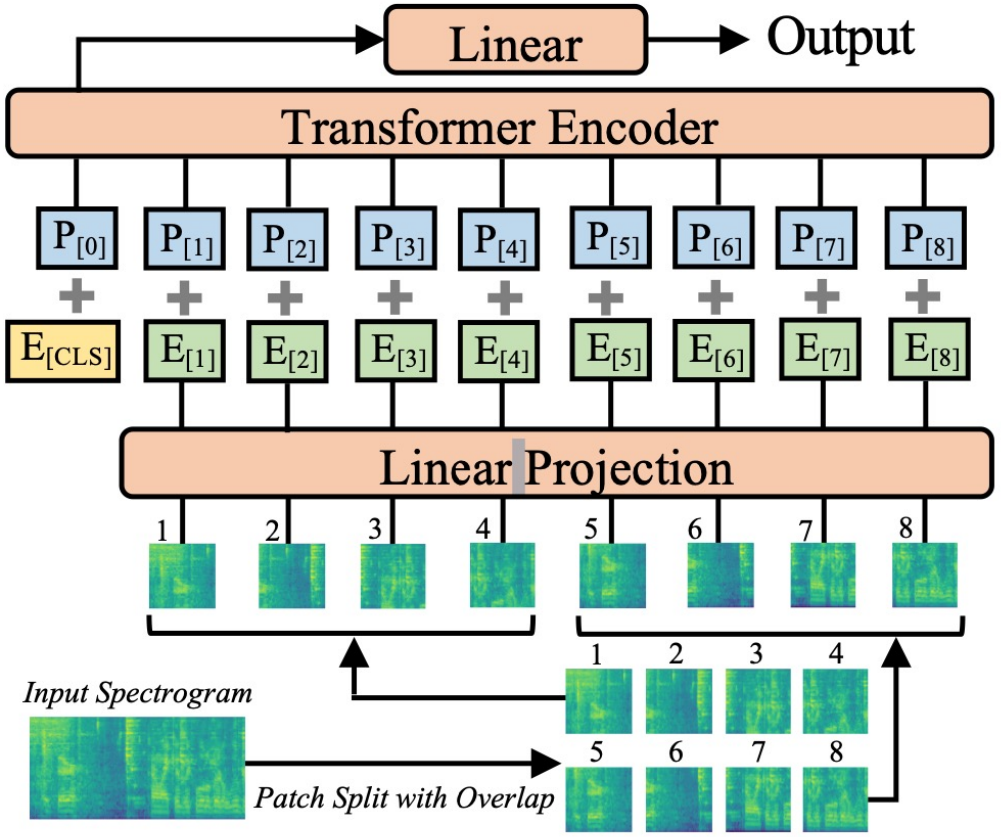
Source: [2]

Offline Voice Based RAG



Audio Classification

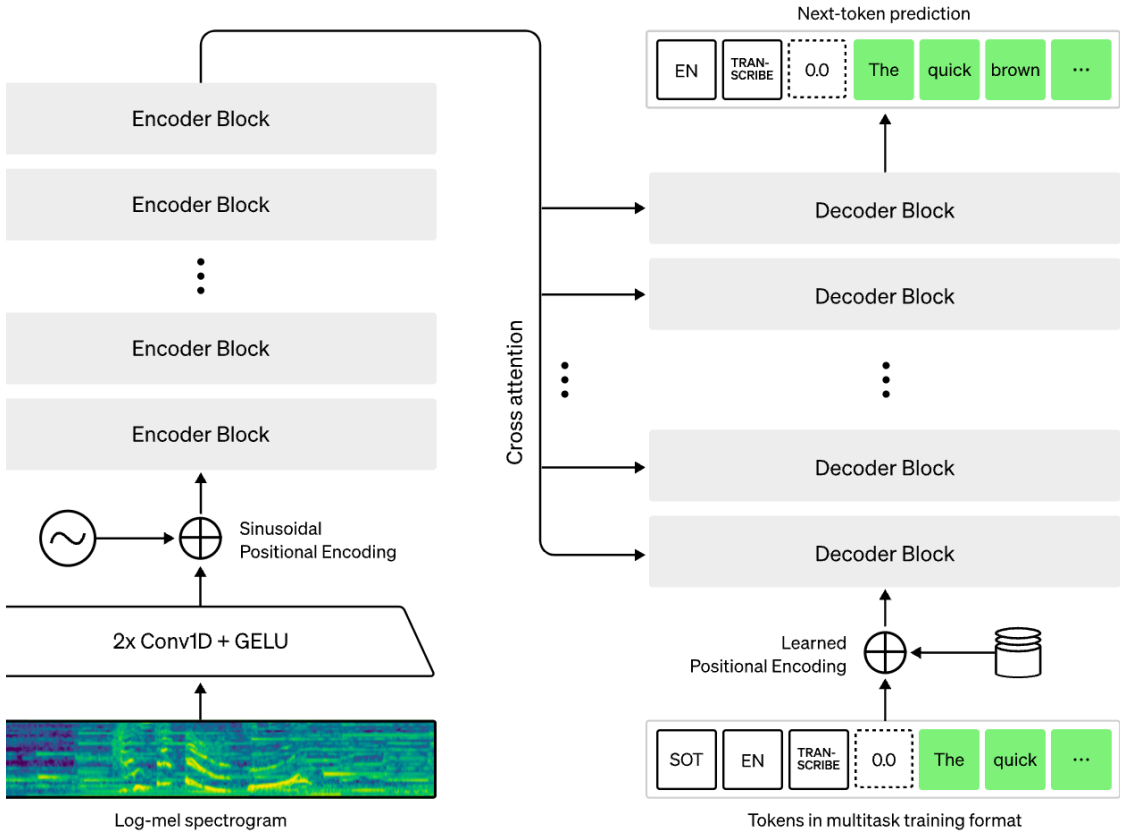
- Audio classification converts audio into a class label
- Audio Spectrogram Transformer (AST) model finetuned on speech commands dataset was used



Source: [3]

Automatic Speech Recognition (ASR)

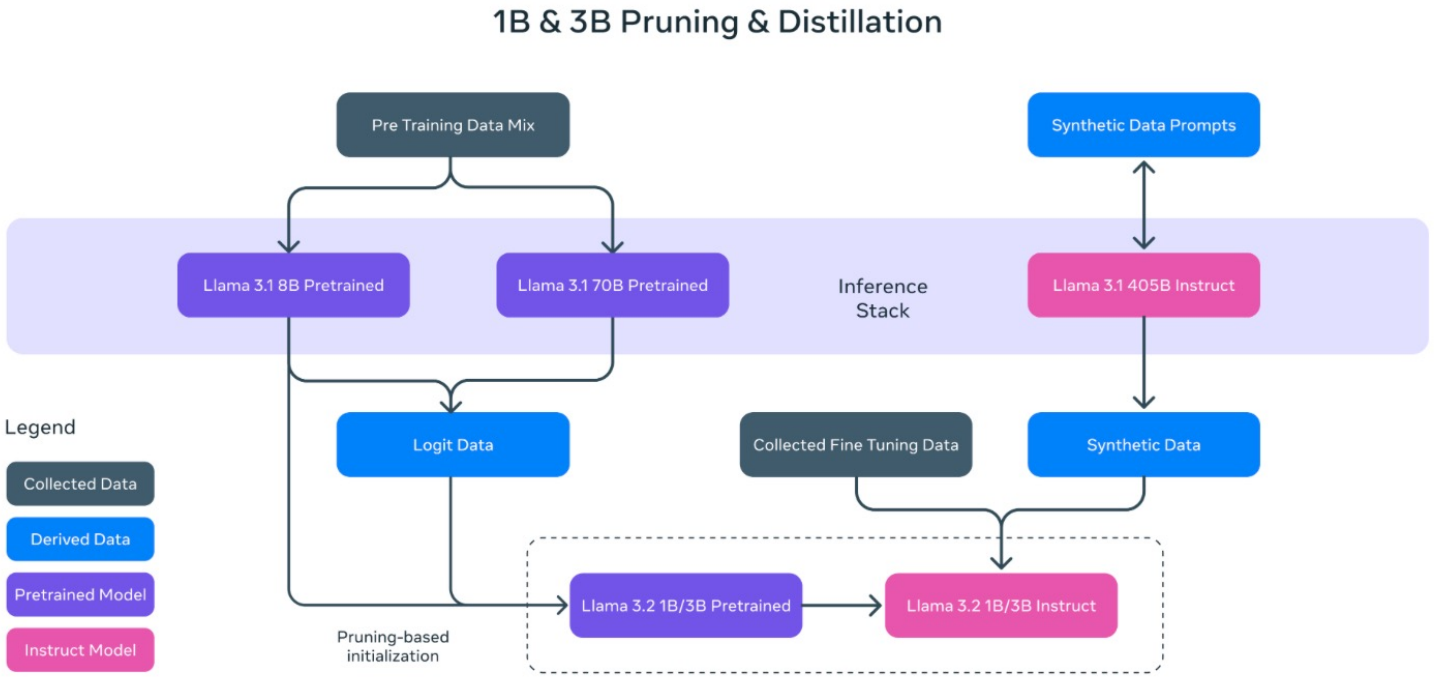
- ASR models convert speech into text
- Whisper model was used in this project



Source: [4]

Vector Database & Large Language Model

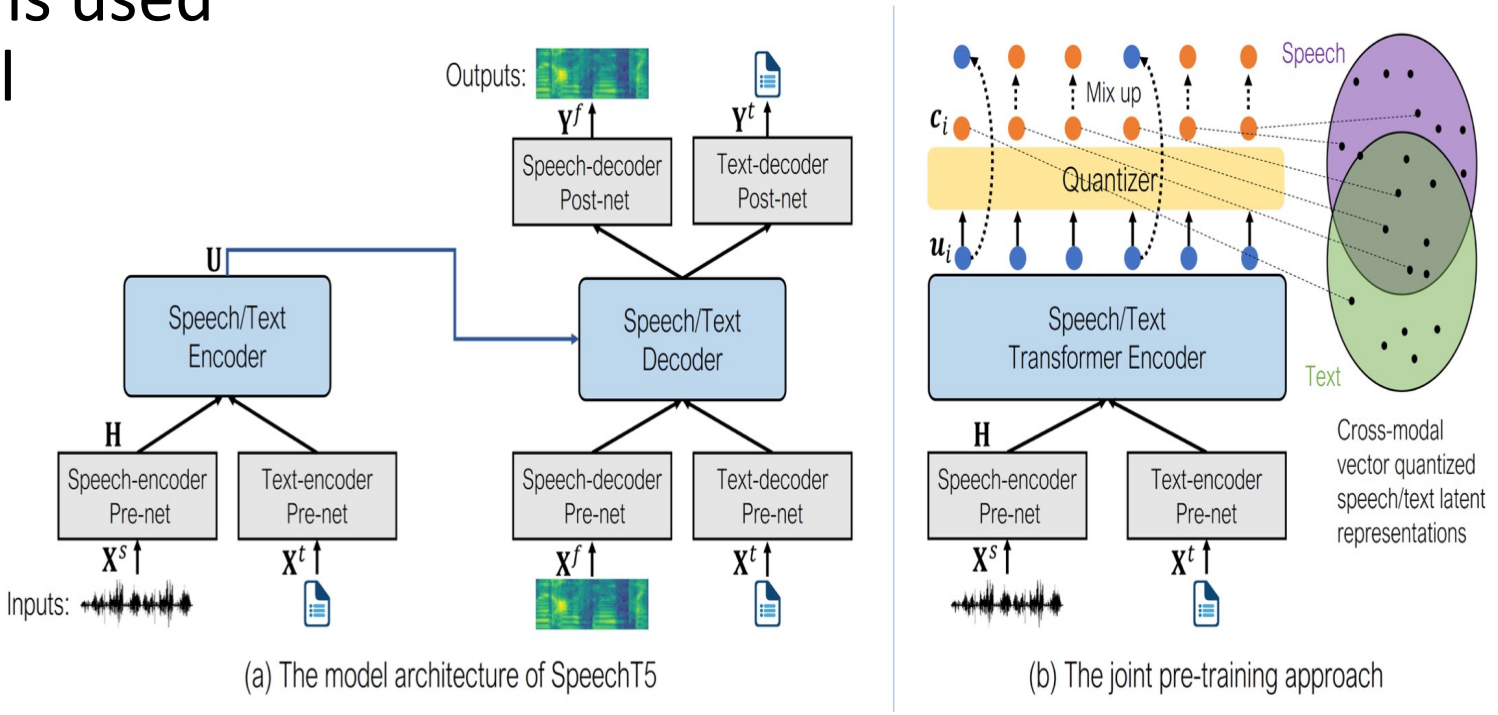
- chromadb is used as the vector database
- Llama 3.2 1B Instruct and 3B Instruct models by Meta are used



Source: [5]

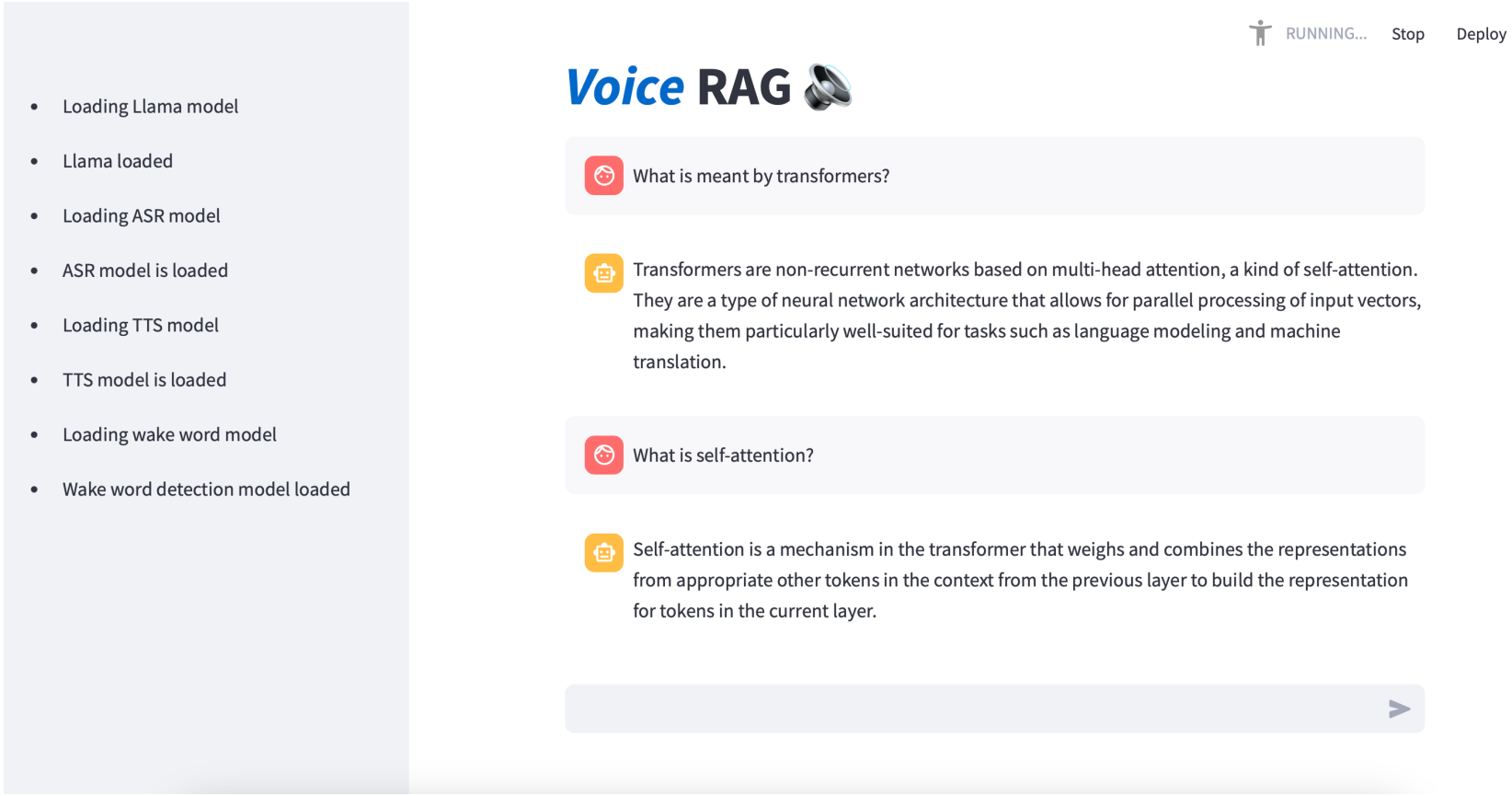
Text to Speech

- SpeechT5 by Microsoft is used as text to speech model



Source: [6]

Demonstration User Interface



References

- [1] P. Lewis *et al.*, “Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks,” Apr. 12, 2021, *arXiv*: arXiv:2005.11401. Accessed: Feb. 19, 2024. [Online]. Available: http://arxiv.org/abs/2005.11401
- [2] ‘Advanced RAG on Hugging Face documentation using LangChain - Hugging Face Open-Source AI Cookbook’. Available: https://huggingface.co/learn/cookbook/en/advanced_rag. [Accessed: Dec. 03, 2024]
- [3] Y. Gong, Y.-A. Chung, and J. Glass, ‘AST: Audio Spectrogram Transformer’. arXiv, Jul. 08, 2021. doi: 10.48550/arXiv.2104.01778. Available: http://arxiv.org/abs/2104.01778. [Accessed: Dec. 03, 2024]
- [4] Open AI., “Introducing Whisper”. Sep. 21, 2023, OpenAI Website Accessed Sep. 28. 2024.

  [Online]. Available https://openai.com/index/whisper/
- [5] “Llama 3.2: Revolutionizing edge AI and vision with open, customizable models,” Meta, Llama 3.2: Revolutionizing edge AI and vision with open, customizable models (accessed Dec. 3, 2024).
- [6] J. Ao et al., ‘SpeechT5: Unified-Modal Encoder-Decoder Pre-Training for Spoken Language Processing’. arXiv, May 24, 2022. doi: 10.48550/arXiv.2110.07205. Available: http://arxiv.org/abs/2110.07205. [Accessed: Dec. 03, 2024]
- [7] D. Jurafsky and J. H. Martin, Speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition with Language Models, 3. ed. Online manuscript released August 20, 2024. https://web.stanford.edu/~jurafsky/slp3.
- [8] ‘Hugging Face – The AI community building the future.’, Nov. 29, 2024. Available: https://huggingface.co/. [Accessed: Dec. 03, 2024]