

SandIQ: AI-Powered Thermal Imaging for Proactive Sand Monitoring



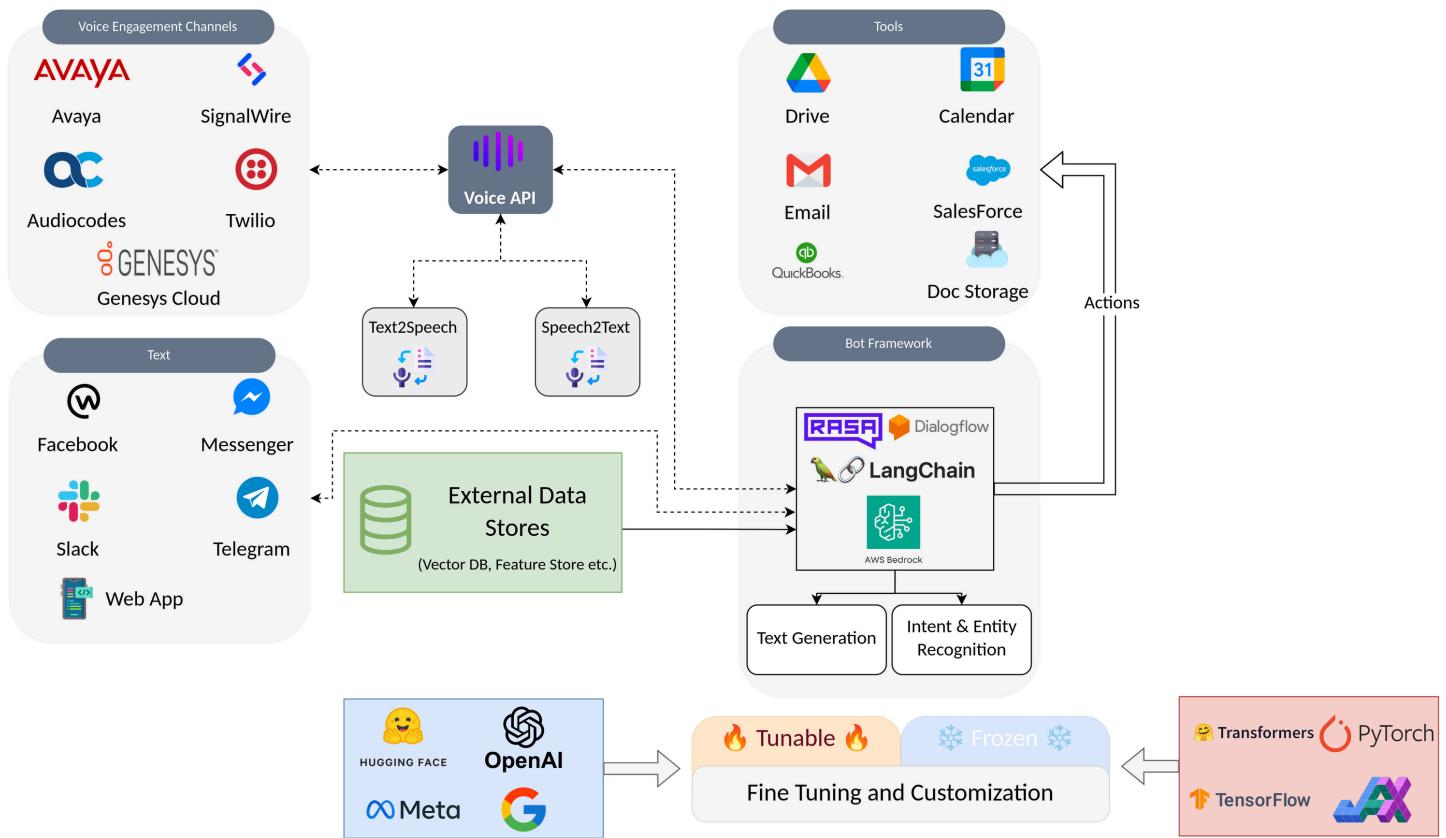
Overview

SandIQ is an innovative AI-driven system designed to revolutionize sand management in oil and gas separators. By leveraging advanced thermal imaging and deep learning, SandPro provides accurate, real-time monitoring of sand accumulation, eliminating the inefficiencies of traditional manual methods or fixed dumping schedules. The solution utilizes a sophisticated hybrid Vision Transformer (ViT) and Convolutional Neural Network (CNN) architecture to analyze thermal data, predicting sand levels with high precision. This enables operators to optimize dump cycles, significantly reducing equipment wear, hauling costs, and fixed schedules.

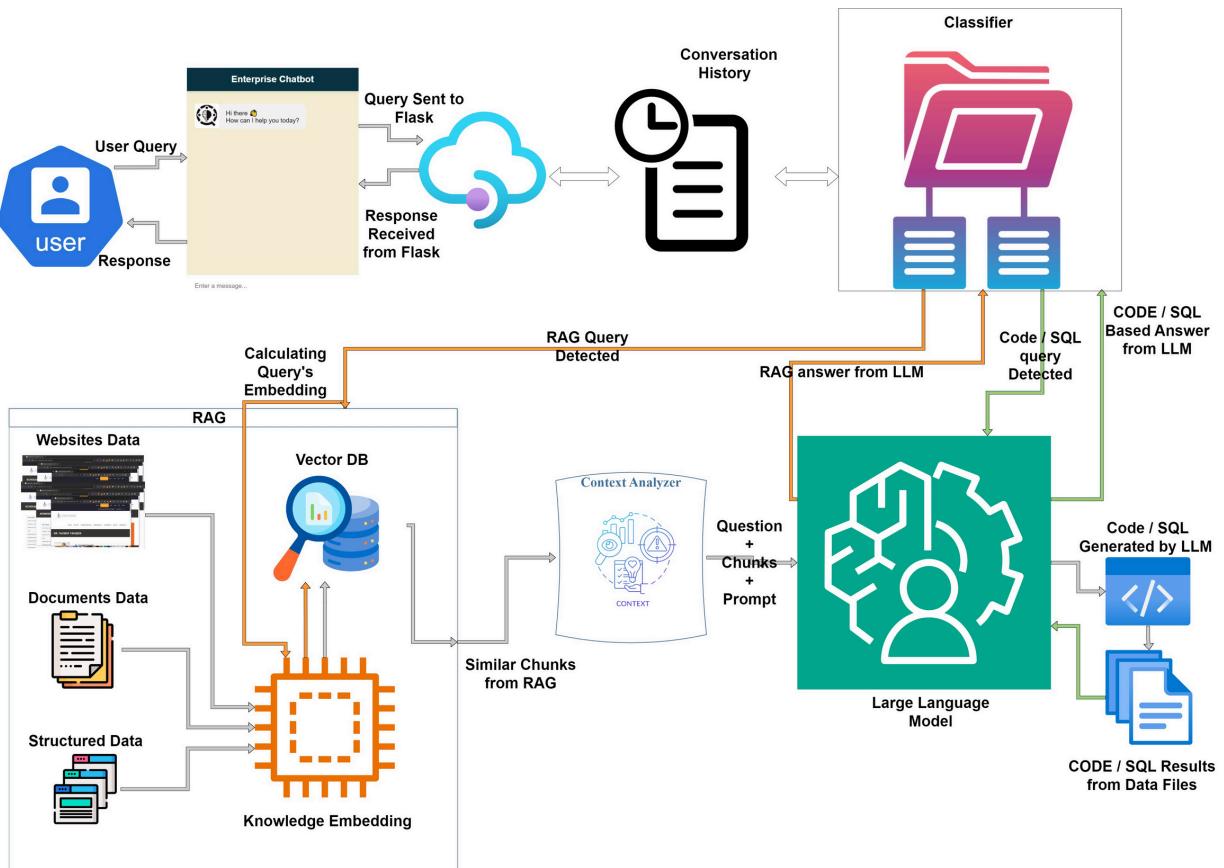
Solution & Implementation

1. A dual-model AI architecture was engineered, combining Vision Transformers (ViT) for superior feature extraction from thermal images with CNNs for enhanced spatial awareness of sand accumulation patterns.
2. A Spatiotemporal Graph Neural Network (ST-GNN) was integrated to analyze sequential thermal frames, enabling predictive analytics for sand level trends over time.
3. The model was trained on a large, diverse dataset of synchronized thermal imagery and utilizing contrastive learning techniques to ensure robustness against environmental variations like temperature fluctuations.
4. The entire AI pipeline was deployed on edge computing devices at the well site for low-latency, real-time inference and seamlessly integrated with existing SCADA systems for operational continuity.

Framework of Conversational AI



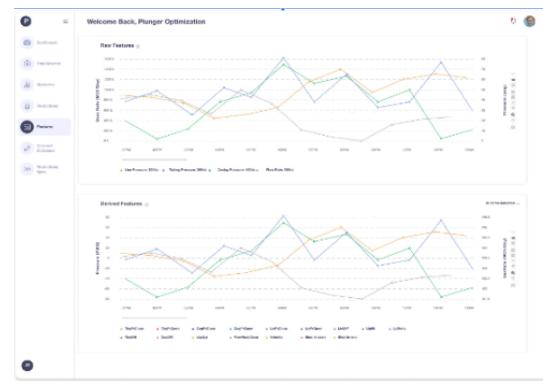
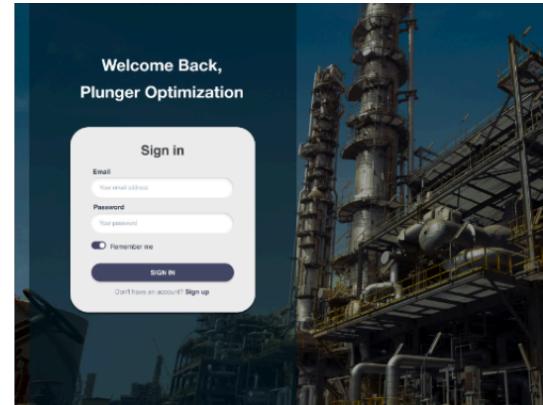
Framework of Enterprise Chatbot



TechStack

- Python, PyTorch, TensorFlow
- Vision Transformer (ViT), CNN, ST-GNN
- OpenCV, FLIR Cameras
- AWS, Docker, Kubernetes
- React, D3.js, FastAPI
- SCADA Integration

Application Showcase

A screenshot of a web application titled "Welcome Back, Plunger Optimization". The page is for "Submit Train Job" and shows a "WELL ID" dropdown menu set to "Select well ID or click here to add new one". Below it is a "WELL ID" input field with "New Well" selected. A "Start Date" input field is set to "2023-01-01". On the right, there are four input fields: "Hydro", "Learning Rate", and "Number of Online", all set to their default values. A "Start" button is at the bottom right.

Customer Profile

A leading enterprise in the oil and gas sector seeking to automate operations.

Industry: Oil & Gas, Energy

Country: USA

Results

The SandIQ system was successfully designed and deployed, delivering a state-of-the-art sand monitoring solution. The AI model achieved a predictive accuracy of 90-95%, enabling a shift from reactive to proactive dump scheduling. This precision directly resulted in a substantial reduction of unnecessary dump cycles, minimizing equipment wear, lowering hauling and disposal costs, and reducing the environmental footprint. The integration of real-time analytics and explainable AI empowered operators with unprecedented visibility into separator conditions, optimizing flowback management and enhancing overall operational efficiency. SandIQ stands as a testament to deploying cutting-edge computer vision and deep learning to solve critical industrial challenges.