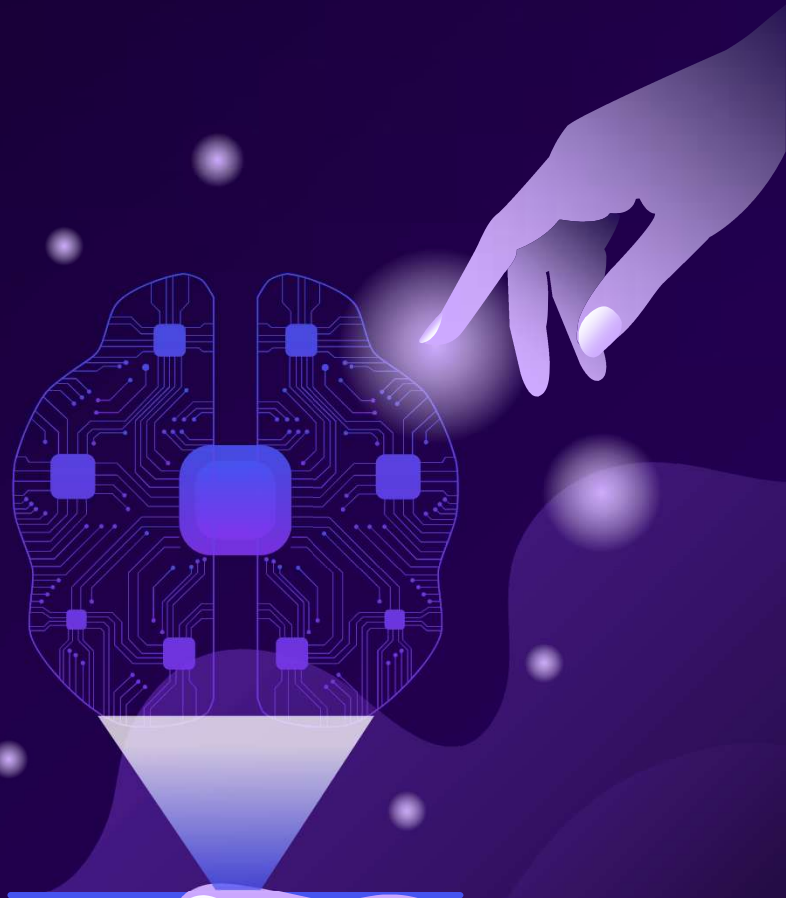
AURA

Real-Time AI Agentic Assistance for Safe, Efficient Industrial Operations

Theme - Multimodal AI
Team Name - RSSR
College - M S Ramaiah Institute of Technology



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Problem Statement

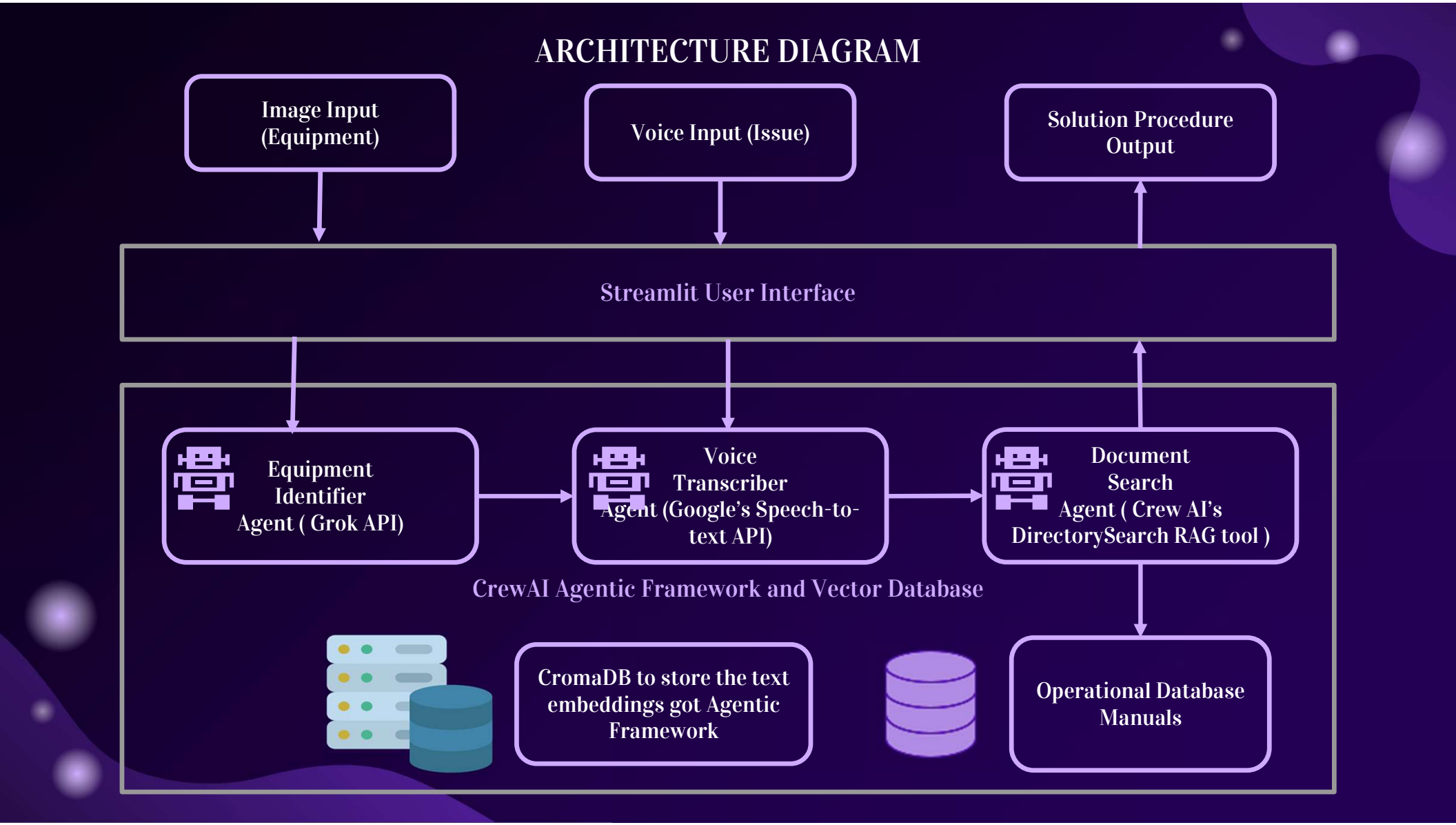
In high-stakes industrial environments, such as refineries and data centers, industrial technicians are responsible for executing complex, **error-prone operational tasks**. The current reliance on voluminous, manual standard operating procedures (SOPs) and delayed guidance from remote experts results in significant **operational inefficiencies**. This outdated approach leads to prolonged task completion times, elevated risks of human error, costly operational downtime, and a lack of **real-time**, traceable data for post-mortem analysis. These challenges directly impact productivity, safety, and profitability.

Challenges

- **High-Pressure, High-Stakes Environment:** Industrial technicians work in critical fields where even a small error can lead to catastrophic failures.
- **Outdated Manual SOPs:** They rely on dense, difficult-to-read manuals that slow down operations and increase the chance of human error.
- **Delayed Expert Guidance:** Technicians often wait for help from remote experts, leading to costly delays and extended downtime.
- **Lack of Traceability:** The current process lacks a clear audit trail, making it nearly impossible to trace actions and ensure accountability after a task.
- **Elevated Operational Risk:** The combination of manual, slow processes and human error significantly increases the risk of accidents, equipment damage, and non-compliance.
- **Costly Operational Downtime:** Inefficient and error-prone work leads directly to expensive shutdowns, impacting productivity and the bottom line.

IMPLEMENTATION DETAILS

- The implementation of **AURA** follows a sequential multi-agent pipeline using **CrewAI** as the orchestration framework.
- The workflow begins with the **Equipment Identifier Agent** leverages the Grok API to recognize the faulty equipment from the image.
- The **Voice Transcriber Agent**, powered by Google's Speech-to-Text API converts technician voice input into structured text.
- Once the issue and equipment are identified, the **Document Search Agent**, using CrewAI's DirectorySearchTool, queries the operational manual to fetch the official step-by-step procedure.
- These results are delivered through a **Streamlit UI**, where technicians can view the guidance in real time and optionally raise multiple issues for the same equipment.
- Finally, all interactions and solutions are logged, and a **downloadable text report** is generated for compliance and audits.
- This modular agent-based design ensures speed, accuracy, and auditability in high-stakes operational environments.


ARCHITECTURE DIAGRAM
Image Input (Equipment)
Voice Input (Issue)
Solution Procedure Output
Streamlit User Interface
Equipment Identifier Agent (Grok API)
Voice Transcriber Agent (Google's Speech-to-text API)
Document Search Agent (Crew AI's DirectorySearch RAG tool)
CrewAI Agentic Framework and Vector Database
CromaDB to store the text embeddings got Agentic Framework
Operational Database Manuals

TECH STACK

Streamlit

Lightweight, interactive interface for technicians to log and monitor issues.

crewai

Multi-agent framework to coordinate specialized AI agents in a sequential flow.

Chroma

Vector database for storing, managing, and retrieving vector embeddings

Groq API
For equipment identification.

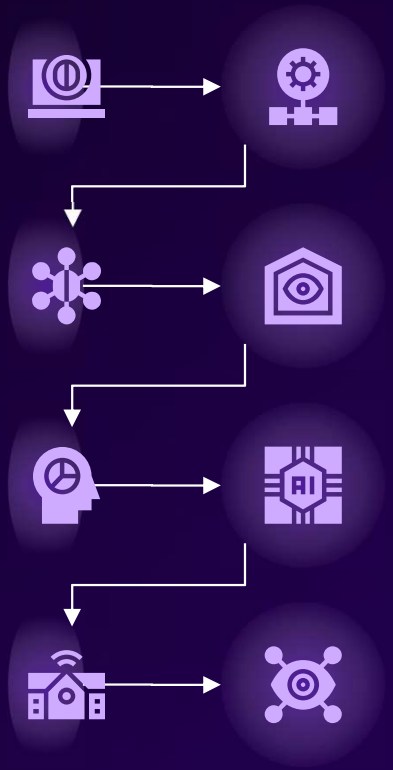
Google's Speech-to-text API
Converts technician voice descriptions into structured text.

DirectorySearchTool
Fetches operational procedures directly from manuals.

Impact & Use Case

Impact

- **Faster Response**: Reduces critical downtime from *minutes to seconds*.
- **Improved Safety**: Minimizes human error under pressure.
- **Operational Efficiency**: Frees technicians to focus on execution, not searching.
- **Compliance Ready**: Automatic, auditable reports for regulatory needs.
- **Cross-Industry Value**: Scalable across high-stakes domains.



Use Cases

- **Manufacturing Plants** – Instant troubleshooting during machine breakdowns.
- **Aviation & Aerospace** – Emergency fault handling with precise protocols.
- **Healthcare** – Rapid diagnosis of equipment malfunctions in critical care.
- **Energy & Utilities** – Field technicians guided on complex repairs.
- **Defense** – Standardized, auditable responses in mission-critical scenarios.

Uniqueness & Innovation

Uniqueness

- First responder **multi-agent AI system** built for operational tasks.
- Seamless **integration of voice, vision, and document intelligence**.
- Generates **compliance-grade audit trails** automatically.
- Technician-friendly **Streamlit UI** with multi-issue handling.

Innovation

- **Agent Orchestration (CrewAI)** – Specialized AI agents working in sequence for speed & accuracy.
- **Multimodal Inputs** – Voice (issues), Image/Video (equipment), Documents (solutions).
- **Adaptive Workflow** – Scales from simple fixes to complex, high-stakes incidents.
- **Future-Ready Extensions** – Predictive maintenance, AR-guided steps, IoT integration.

OUR TAKEAWAYS

- Learned integration of **multi-agent AI systems (CrewAI orchestration)**.
- Hands-on with **real-time speech-to-text** (Google Cloud API).
- Implemented image-based equipment recognition (Groq API).
- Applied RAG techniques on technical PDFs/manuals.
- Experience in building a **Streamlit-based interactive UI**.
- Improved skills in team collaboration under hackathon timelines.

ROAD AHEAD

- Extend support for multi-language transcription & instructions.
- Scale document ingestion to thousands of manuals across domains.
- Integrate with **augmented reality (AR)** glasses for hands-free technician support.
- Enable predictive diagnostics using **IoT sensor data + AI**.
- Enhance system with offline support for remote/low-connectivity areas.
- Expand into cross-industry applications (healthcare, manufacturing, aviation).
- Add continuous learning pipeline → system improves with every incident logged.