



JPL AiSTRA: AI System for Testbed Recording and Analysis



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Problem Statement

Why AiSTRA?

- JPL testbed sessions require operators to monitor hardware, telemetry, and anomalies in real time.
- Manual note-taking divides attention during long, noisy operations.



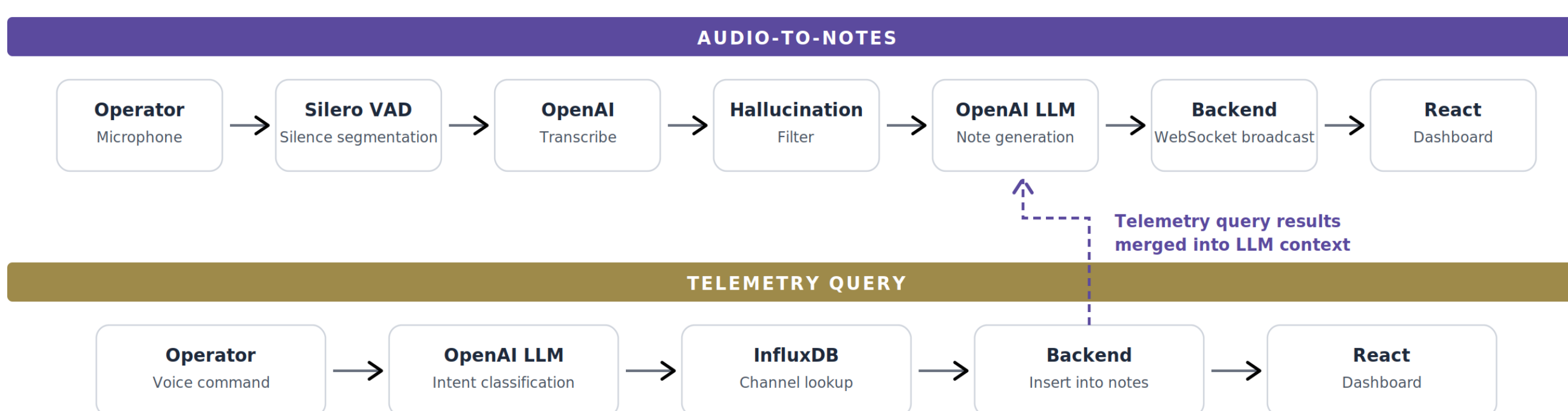
Objective :

- Build AiSTRA, an AI-assisted documentation system for testbed operations.
- Convert operator speech and telemetry context into structured and timestamped notes.
- Provide a shared dashboard for review, edition, and export.

Requirements

- **Real-time transcription:** Low speech-to-text latency for operations; operators do not need to pause the workflow to wait for transcription.
- **Structured notes:** Auto-classifies speech into Detail, Anomaly, and Summary notes.
- **Hallucination suppression:** Filter out false transcriptions caused by background noise or silence.
- **Telemetry integration:** Voice-triggered queries to InfluxDB by channel and time range.
- **Collaborative interface:** AI-generated notes and operator-written notes coexist in a shared real-time view.
- **Export:** JSON and Markdown with timestamps.

Data Flow



Implementation

Speech-to-Text Pipeline:

- Silero VAD (PyTorch) segments audio by ~1.5s silence threshold.
- Two-stage hallucination filter (no_speech_prob + avg_logprob thresholds) suppresses noise-generated phantom notes.

Structured Note Engine:

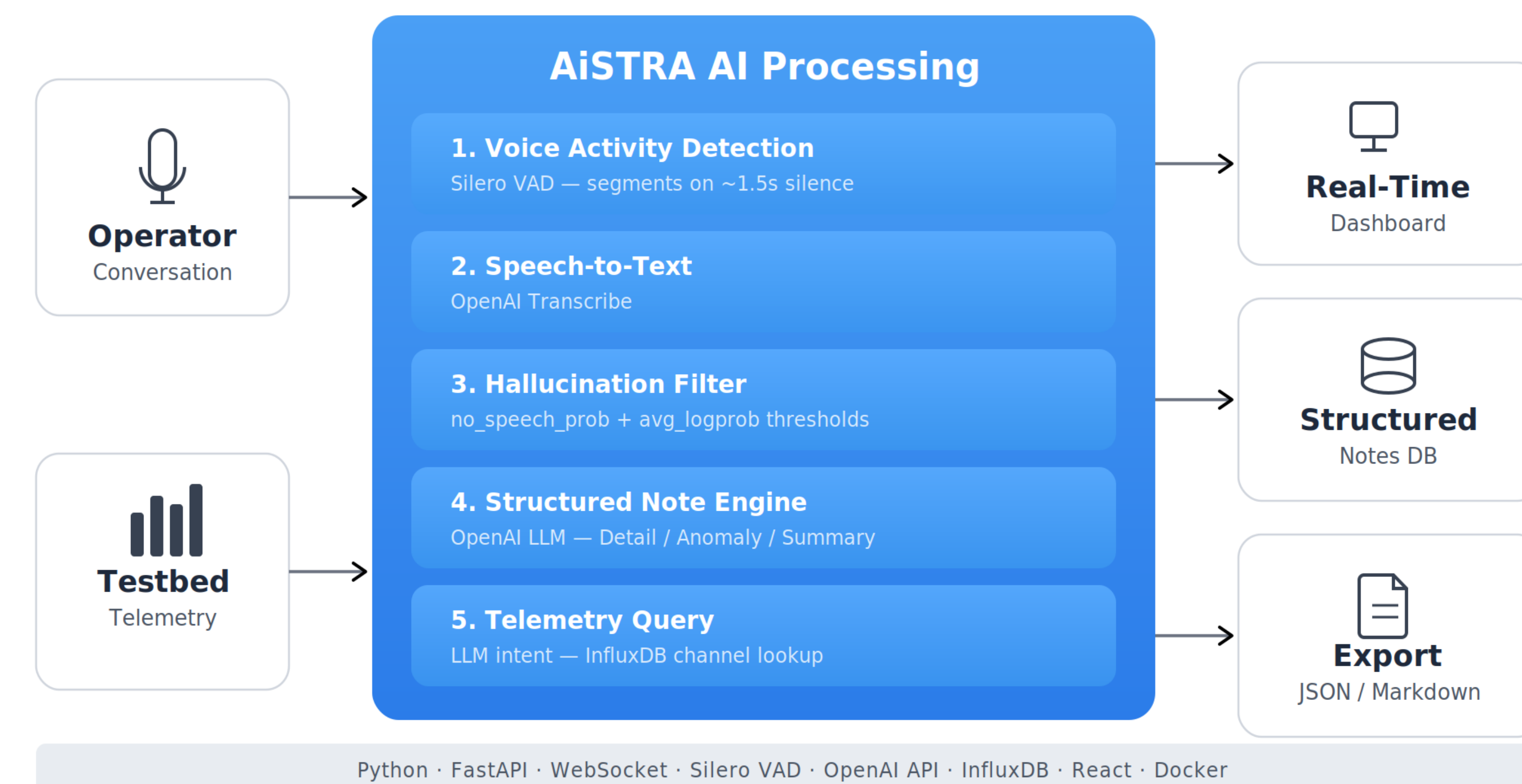
- OpenAI LLM classifies operator speech into three note types: Detail, Anomaly, Summary.

Telemetry Integration:

- Mock telemetry datasets ingested into InfluxDB; queryable by channel, time range, aggregations (list, latest, min, max).
- Voice-triggered query: operator speech → LLM intent classification → InfluxDB queries → result inserted into notes.

Backend & Frontend:

- FastAPI + WebSocket real-time broadcast; Docker Compose containerization.



Future Work / References

Future Work:

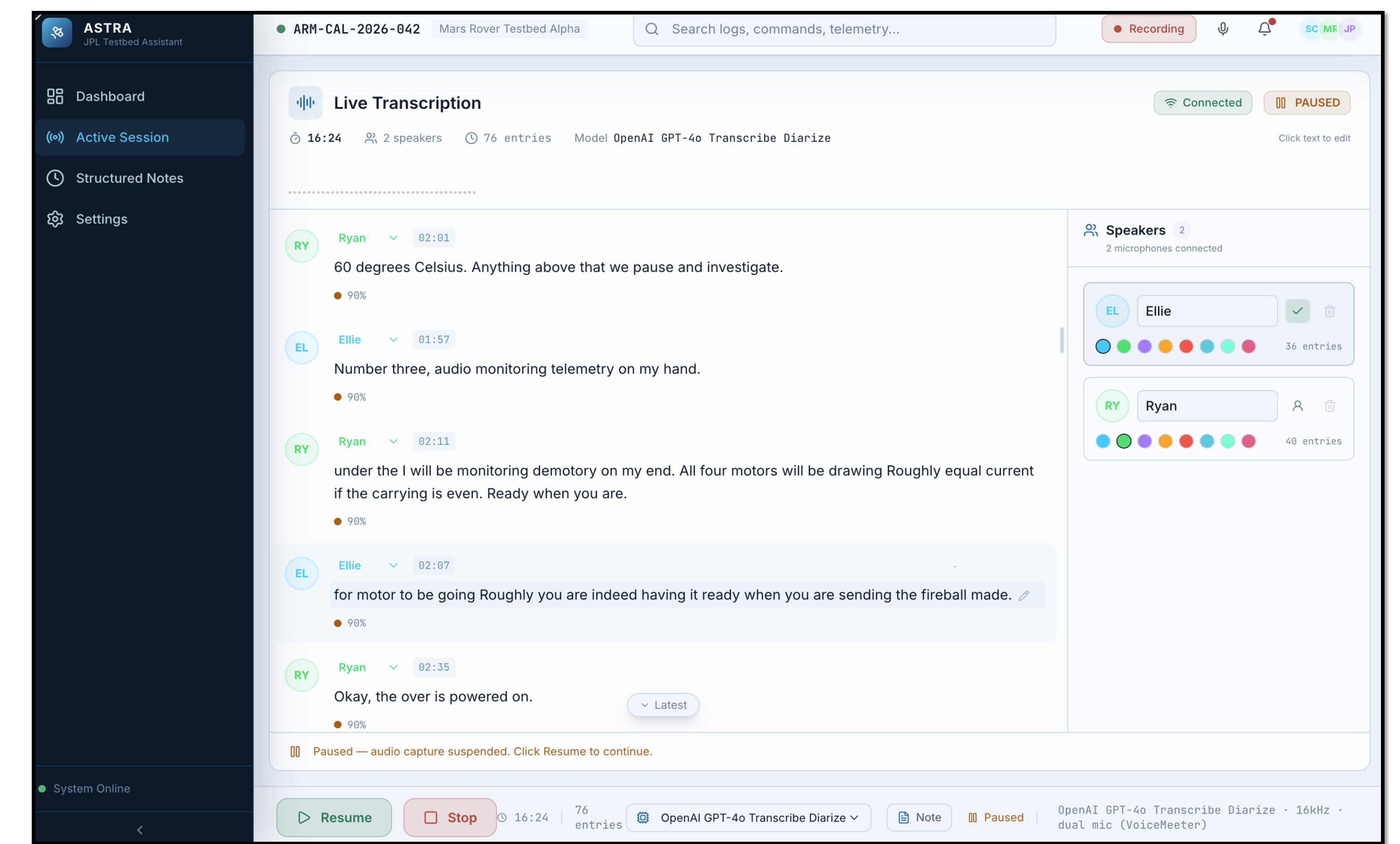
- Insert telemetry plots into notes via voice command with click-to-expand display, reducing operator effort to manually process and screenshot data
- RAG integration to upload test procedures and manuals so the LLM uses project-specific terminology and acronyms

[1] OpenAI, Speech to text, OpenAI API Documentation, 2026.

[2] InfluxData, InfluxDB Documentation, InfluxData, 2026.

[3] M. Barański, J. Jasiński, J. Bartolewska, S. Kacprzak, M. Witkowski, and K. Kowalczyk, Investigation of Whisper ASR Hallucinations Induced by Non-Speech Audio, arXiv preprint arXiv:2501.11378, 2025.

Results



Results:

- Functional prototype delivered to JPL sponsor.
- End-to-end audio-to-notes pipeline operational in real time.
- Three note types (Detail, Anomaly, Summary) validated through user interview with JPL rover operator.
- Voice telemetry query delivered: 6 test scenarios, 220K+ records in InfluxDB.
- Hallucination filter suppresses phantom notes from testbed background noise.
- Notes export: JSON and Markdown with timestamps for post-test archival.

