



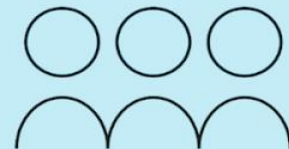
Hack-AI-thon

2025-26 Edition



Engineering the Next Breakthrough

Organized by *GDG on Campus* NKOCET



Team Details

- Team name: SonicGuardians
- Team leader name: Preeti Jadhav
- Problem Statement: Open Innovation



WhisperNet

WhisperNet uses **AI** to **detect early machine faults** by analyzing **subtle sounds**, preventing **unexpected breakdowns** and **costly repairs**.

Problem

Undetected machine faults lead to unexpected **breakdowns, downtime,** and **high maintenance costs.**

Abnormal sounds from fans, motors, and equipment often **ignored by humans**

Damages are **detected late,** after **costly breakdowns**

Traditional monitoring systems are **expensive** and **complex**

Solution

WhisperNet captures machine sound via an **ESP32**, analyzes it using **AI**, and **displays alerts** and insights in a Firebase dashboard.

ESP32 with **microphone** module **captures** ambient **machine noises.**

AI classifies sound as **normal or faulty.** Like bearing noise or imbalance.

Firebase dashboard shows real-time **alerts, fault details** and **suggestions**

Opportunities of WhisperNet

How different is it from other ideas?

- Uses **sound-based AI** instead of images or vibration.
- Prevents breakdowns, just doesn't detect.
- Suitable for Labs, factories and IOT applications.
- Combines **Edge sensing + Cloud AI + GenAI explanati**

How will it solve the problem?

- Continuously listens to machine sound patterns.
- AI identifies abnormal acoustic signatures.
- Predicts **fault type & urgency**.
- Provides **clear maintenance actions** before breakdown.



Key Features of WhisperNet



Sound-Based Fault Detection

Uses acoustic signals instead of cameras or vibration sensors to identify early machine faults.



Early Failure Prediction

Detects abnormalities before visible damage or breakdown occurs.



AI-Powered Classification

Classifies machine condition as Normal or Faulty with confidence percentage.



Cross-Machine Compatibility

Can be applied to fans, motors, transformers, and lab equipment.



Gemini-Powered Fault Explanation

Converts AI output into simple explanations and preventive maintenance suggestions.



Real-Time Monitoring Dashboard

Displays machine status, confidence score, and alerts via Firebase.



Low-Cost & Scalable Design

Works with basic microphones and ESP32, making it affordable and expandable.



Data Logging & History Tracking

Stores past predictions for analysis and maintenance planning.



Transforming machine sounds into actionable maintenance intelligence.



Google Technologies used



Firebase

- Real-time **data storage**
- Prediction **history** logging
- Session **persistence**
- Dashboard state restore



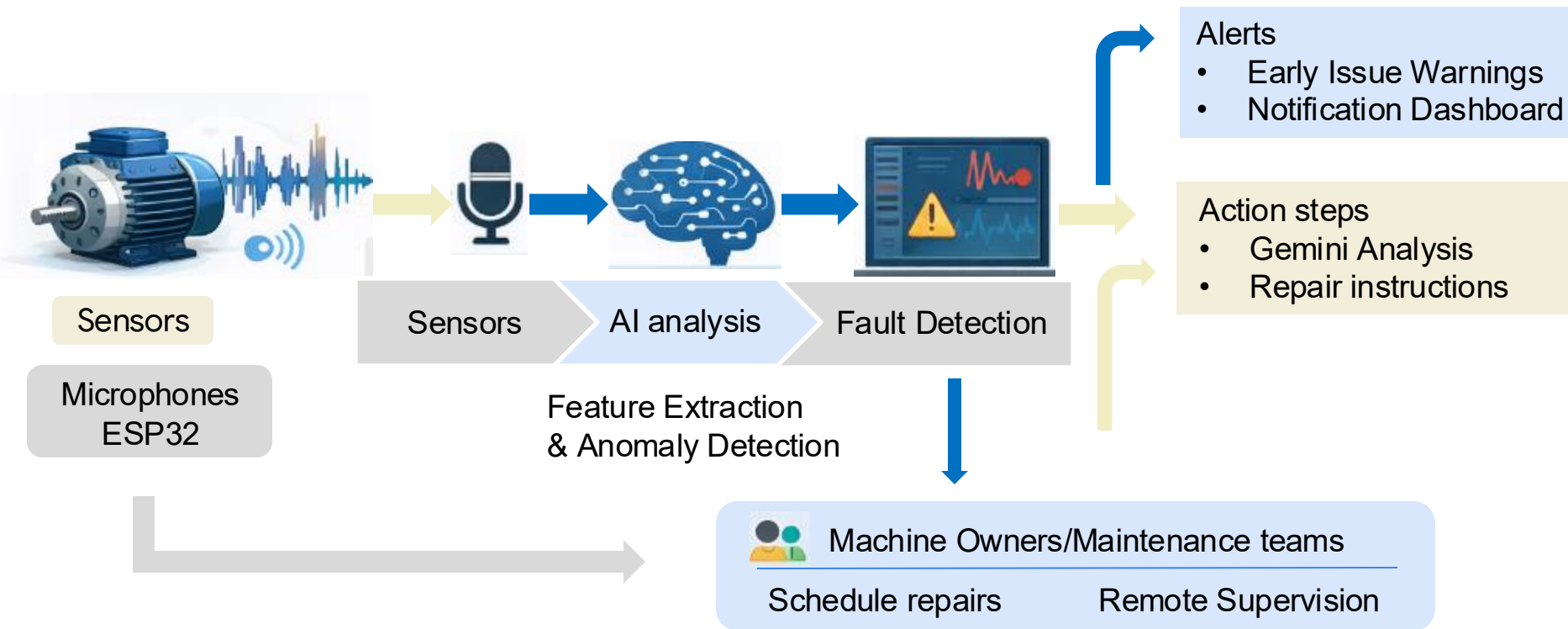
Gemini

Google AI

- AI-based **fault explanation**
- **Corrective** action suggestions
- Natural language insights from predictions

WhisperNet – AI-Based Machine fault detection system

Process flow / Use-case diagram

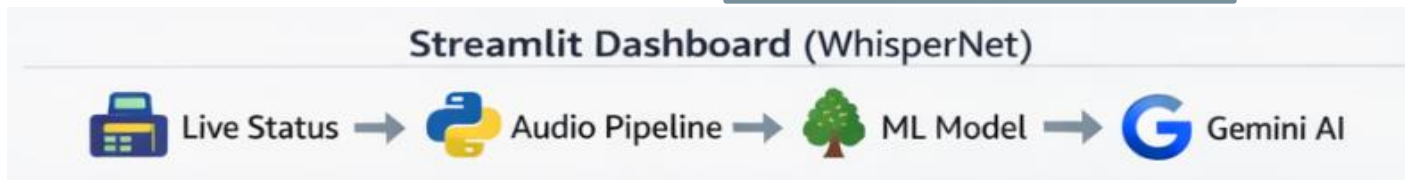
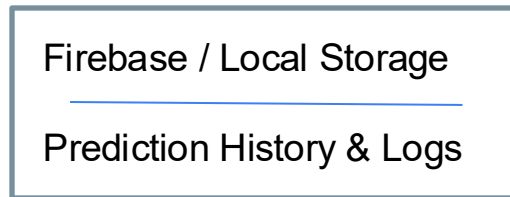
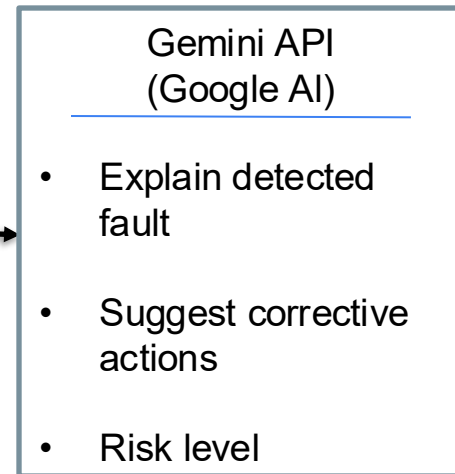
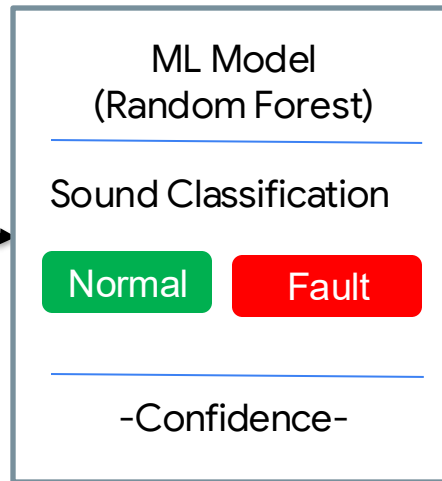
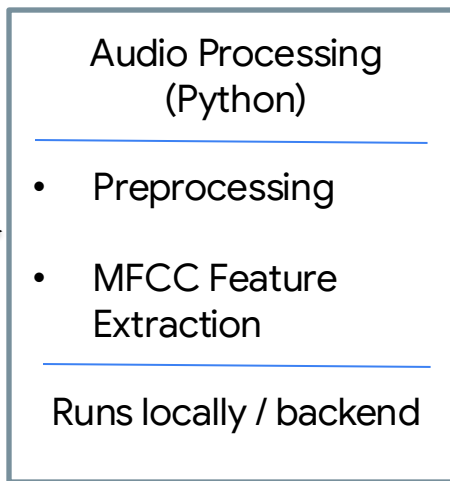


Mic → ESP32 → Python → MFCC → ML → Decision → Explanation

WhisperNet Architecture

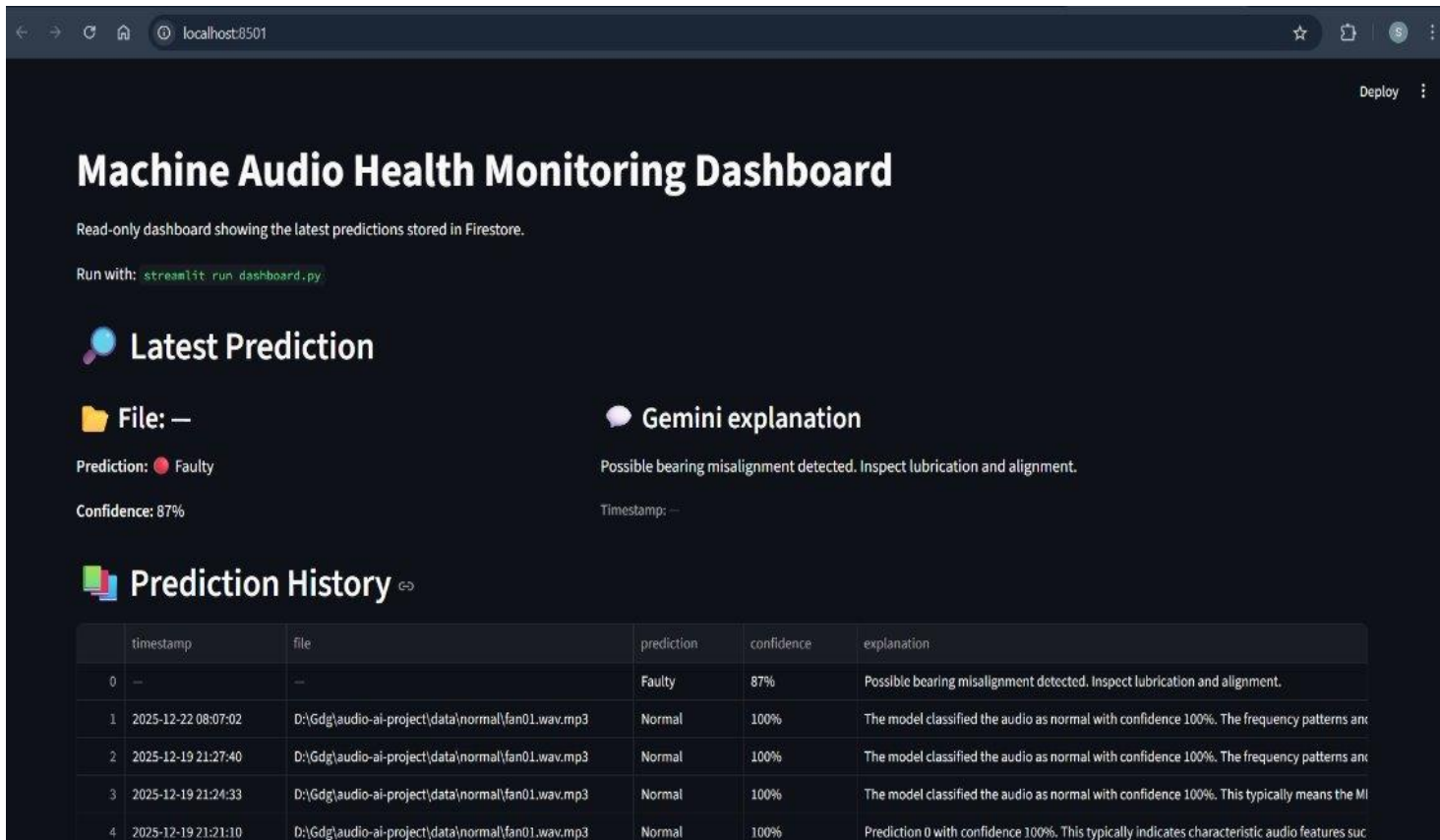


Machine Sound Signal



Snapshots of the MVP

"Dashboard displaying real-time machine health, AI predictions, confidence levels, and Gemini-generated fault explanations."



Machine Audio Health Monitoring Dashboard

Read-only dashboard showing the latest predictions stored in Firestore.

Run with: `streamlit run dashboard.py`

Latest Prediction

File: —

Prediction: ● Faulty

Confidence: 87%

Gemini explanation

Possible bearing misalignment detected. Inspect lubrication and alignment.

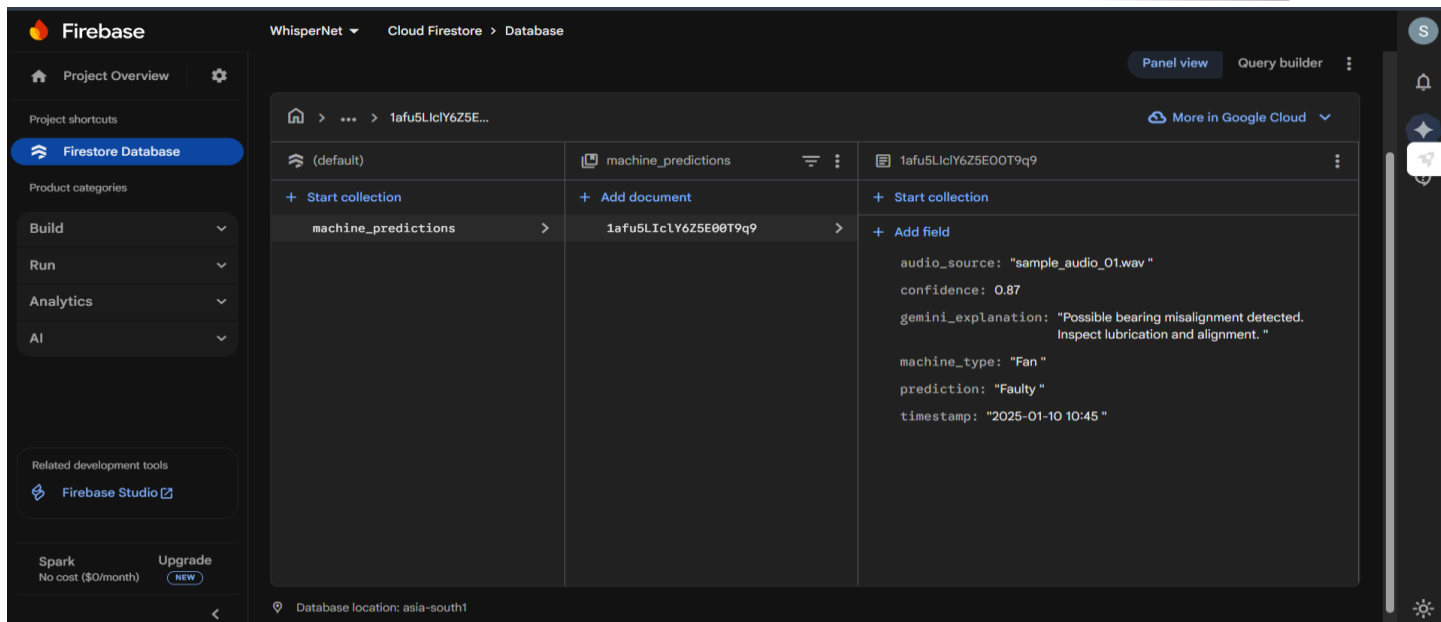
Timestamp: —

Prediction History

	timestamp	file	prediction	confidence	explanation
0	—	—	Faulty	87%	Possible bearing misalignment detected. Inspect lubrication and alignment.
1	2025-12-22 08:07:02	D:\Gdg\audio-ai-project\data\normal\fan01.wav.mp3	Normal	100%	The model classified the audio as normal with confidence 100%. The frequency patterns are
2	2025-12-19 21:27:40	D:\Gdg\audio-ai-project\data\normal\fan01.wav.mp3	Normal	100%	The model classified the audio as normal with confidence 100%. The frequency patterns are
3	2025-12-19 21:24:33	D:\Gdg\audio-ai-project\data\normal\fan01.wav.mp3	Normal	100%	The model classified the audio as normal with confidence 100%. This typically means the MI
4	2025-12-19 21:21:10	D:\Gdg\audio-ai-project\data\normal\fan01.wav.mp3	Normal	100%	Prediction 0 with confidence 100%. This typically indicates characteristic audio features suc

Snapshots of the MVP

"Cloud Firestore storing machine sound predictions, confidence scores, timestamps, and AI-generated maintenance insights."



```
Connected to COM3 @ 115200. Listening for audio chunks...
Bytes waiting: 0
NORMAL (RMS=0.041118)
Explanation: Sound pattern is stable and consistent with normal operation.
Bytes waiting: 2048
FAULTY (RMS=0.050126)
Explanation: High vibration intensity detected, indicating possible mechanical looseness or friction.
Bytes waiting: 2048
NORMAL (RMS=0.037609)
Explanation: Sound pattern is stable and consistent with normal operation.
```

"Live machine audio streamed from ESP32, analyzed in real time to classify NORMAL and FAULTY conditions with RMS-based detection."

Additional Details/Future Development

Additional Details

➤ Edge AI Processing

Processing directly on microcontrollers for faster, local results



➤ Adaptive Models

AI models that continuously adapt to diverse machine types



➤ Seamless Integration

Easy links to IoT platforms like AWS, Google cloud



Future Development

➤ Predictive Maintenance

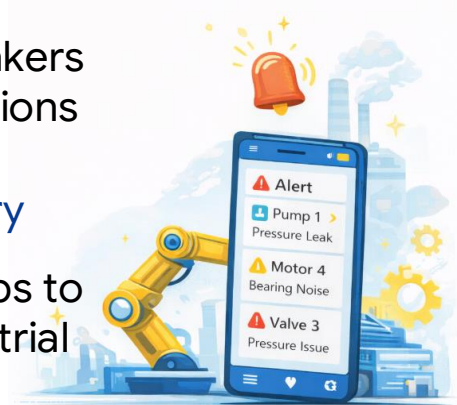
From anomaly detection to prediction of exact failure times

➤ Mobile & Voice Alerts

Apps and smart speakers for real time notifications

➤ Expanding Industry

Use Broaden from labs to power plants & industrial sites



Provide links to your:

1. **GitHub Public Repository :-** <https://github.com/KShruti772/ai-sound-fault-detection>
2. **Demo Video Link (3 Minutes) :-** <https://drive.google.com/file/d/1WAFJejhLXH7i29WiSJropGD-ntF-SfyH/view?usp=drivesdk>
3. **MVP Link :-** <https://ai-sound-fault-detection-rmszwuxpm5amx4hljqrrv.streamlit.app/>



Google Developer Group
On Campus

TechSprint



Leveraging the power of AI



Thank you!

