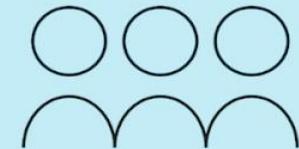


# Hack-AI-thon

2025-26 Edition

*Engineering the Next Breakthrough*

Organized by *GDG on Campus NKOCET*



## Team Details

- a. Team name: SonicGuardians
- b. Team leader name: Preeti Jadhav
- c. 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 explanations**

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



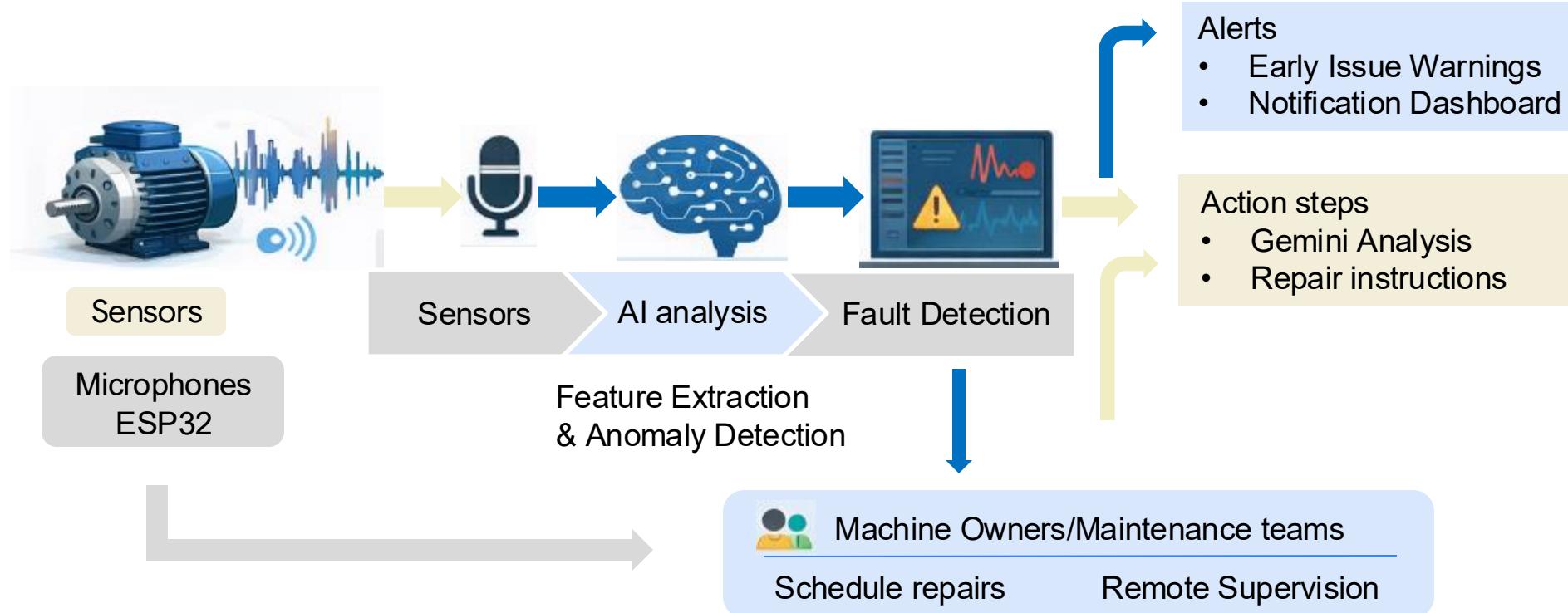
## Gemini

Google AI

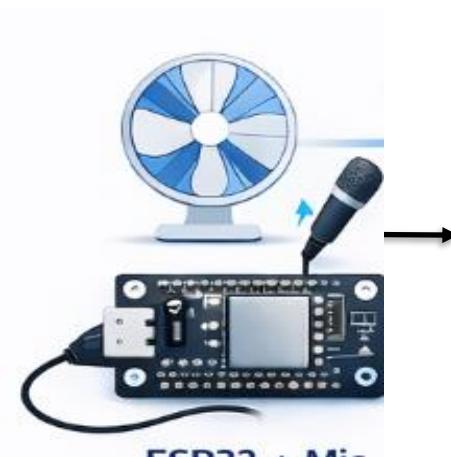
- AI-based **fault explanation**
- **Corrective** action suggestions
- Natural language insights from predictions

**WhisperNet** – AI-Based Machine fault detection system

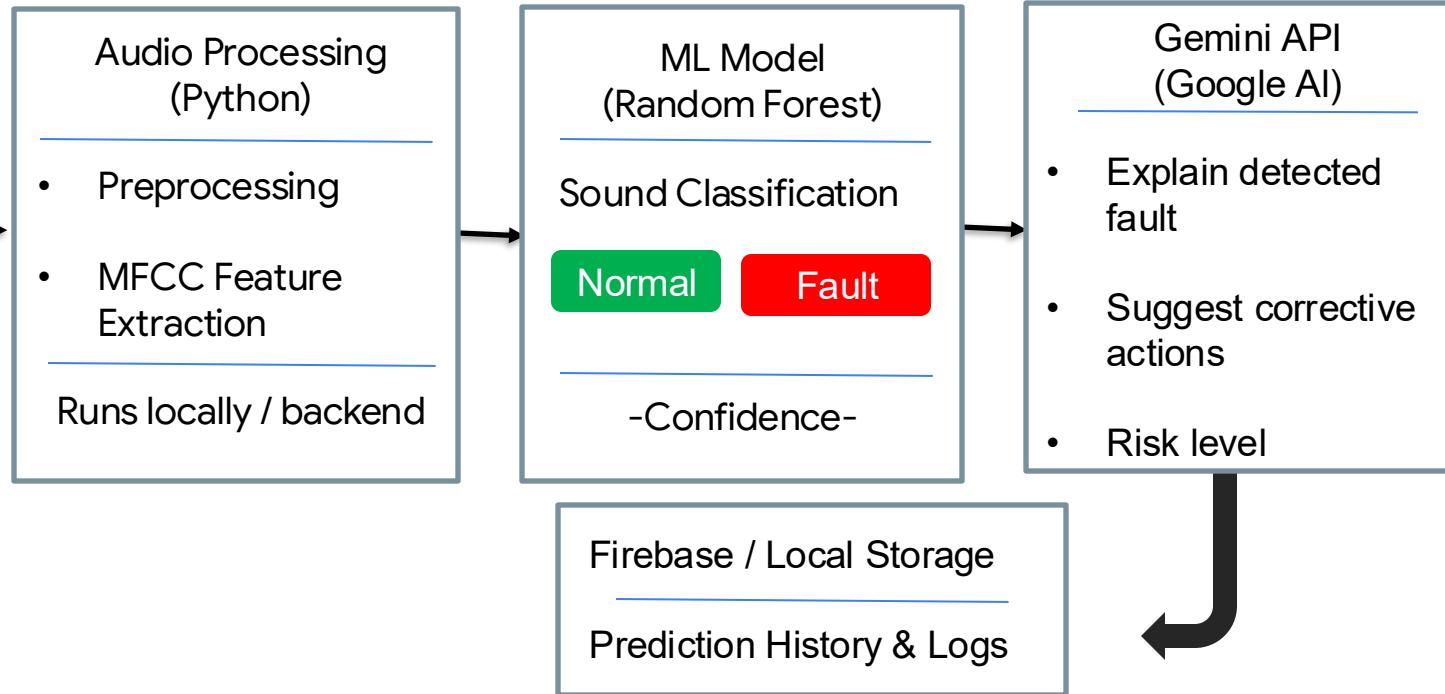
# Process flow / Use-case diagram



# WhisperNet Architecture



Machine Sound Signal



## Streamlit Dashboard (WhisperNet)



Live Status



Audio Pipeline



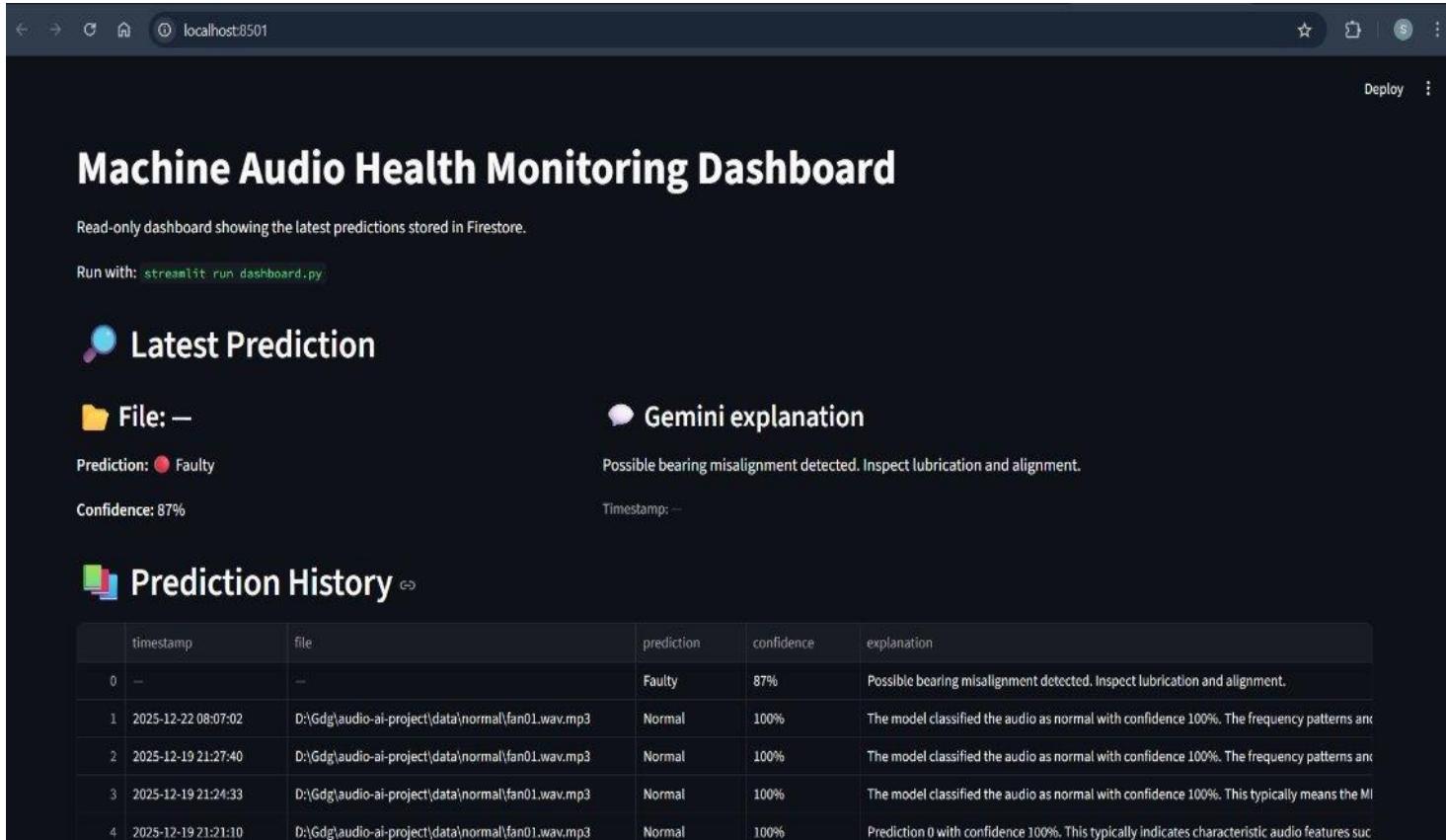
ML Model



Gemini AI

# Snapshots of the MVP

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



The screenshot shows a Streamlit application running at localhost:8501. The title is "Machine Audio Health Monitoring Dashboard". It's a dark-themed dashboard with white text and light-colored icons.

**Latest Prediction:** File: —  
Prediction: Faulty  
Confidence: 87%

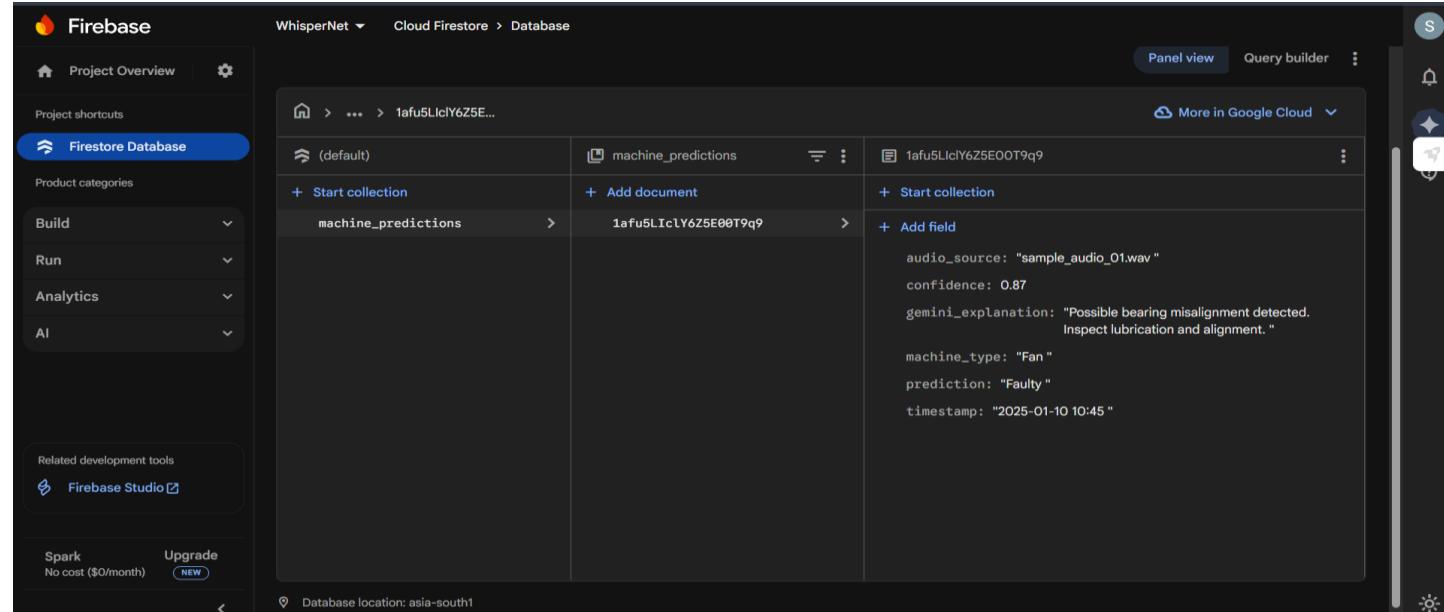
**Gemini explanation:**  
Possible bearing misalignment detected. Inspect lubrication and alignment.  
Timestamp: —

**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 and amplitudes are consistent with a healthy fan.
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 and amplitudes are consistent with a healthy fan.
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 fan is operating normally.
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 such as low-frequency hums or silence.

# Snapshots of the MVP

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



The screenshot shows the Firebase Cloud Firestore interface. The left sidebar lists project categories: Build, Run, Analytics, and AI. The main area displays a document structure under the 'machine\_predictions' collection. The document ID is '1afu5LlcLY6Z5E00T9q9'. The fields include:

- audio\_source: "sample\_audio\_01.wav"
- confidence: 0.87
- gemini\_explanation: "Possible bearing misalignment detected. Inspect lubrication and alignment."
- machine\_type: "Fan"
- prediction: "Faulty"
- timestamp: "2025-01-10 10:45"

```
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-ntFSfyH/view?usp=drivesdk>
  
3. **MVP Link :-** <https://ai-sound-fault-detection-rmszwuxpm5amx4hljqqrsv.streamlit.app/>

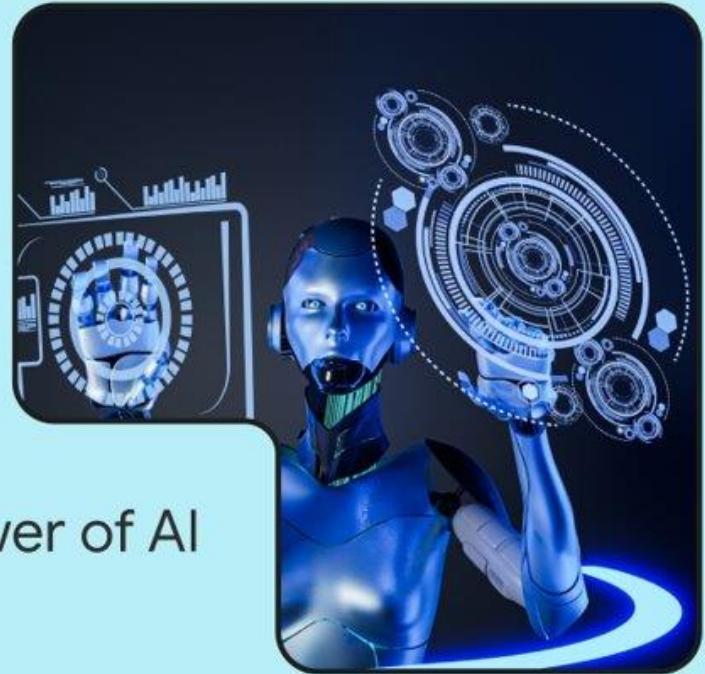


Google Developer Group  
On Campus

# TechSprint



Leveraging the power of AI



# Thank you!

