Hive Monitor - Microphone Sensing Concept Overview

1. Overview

This document outlines the microphone sensing subsystem of the hive monitor project.

It describes how acoustic data from the hive will be captured using the onboard PDM microphone on the Adafruit Feather nRF52840 Sense, processed using FFT, and analyzed to detect changes in hive activity.

2. Hardware

- Microcontroller: Adafruit Feather nRF52840 Sense
- Microphone: Built-in PDM MEMS microphone
- Sampling Rate: 16 kHz
- FFT Window Size: 512 samples
- Power Strategy: Wake every 10 minutes, sample audio, process FFT, return to sleep

3. Frequency Bands

- Band 1 (B1): 200-300 Hz - Normal hive hum
- Band 2 (B2): 300-600 Hz - Queen piping
- Band 3 (B3): 600-1000 Hz - Swarming agitation
- Band 4 (B4): 1000-3000 Hz - Alarm or disturbance

4. Default Classification Thresholds

- THRESH_B1 = 0.6 (Normal hum)
- THRESH_B2 = 0.4 (Queen activity)
- THRESH_B3 = 0.3 (Swarming)
- THRESH_B4 = 0.2 (Alarm/disturbance)
- THRESH_SILENT = 0.1 (Possible absconding)

5. Output Format

Each audio capture session logs:

- Timestamp

- Band Energy Values (B1-B4)

- Classification Result

Example:

2025-04-10T18:00:00Z | B1: 0.72 | B2: 0.14 | B3: 0.04 | B4: 0.01 | Status: Normal

6. Configurability

Threshold values can be updated through:

- Config file on SD card

- BLE command (future feature)

- Hardcoded overrides for testing

This allows fine-tuning during real-world deployment.