Hive Monitor - Communication and Data Logging Concept Overview

1. Overview

This document outlines the communication and data logging subsystem of the hive monitor project. It describes how sensor data is stored, retrieved, and optionally transmitted via Bluetooth or other interfaces. This enables remote monitoring, system updates, and historical analysis.

2. Data Storage

- Primary storage: microSD card (FAT32)
- Format: plain text or CSV logs for compatibility
- Each entry includes timestamp, sensor data, and optional classification/alerts
- Modular logs per subsystem (e.g., audio, environment, motion, weight)

3. Communication Interfaces

- BLE (Bluetooth Low Energy) for:
  - System status and last readings
  - File preview or selective retrieval
  - Configuration updates (e.g., wake interval, thresholds)
- USB serial (optional for debugging or local access)
- Future optional support for LoRa or mesh networking

4. File Structure and Format

- Files named by date or subsystem, e.g., env_20250410.csv
- Example log entry:

2025-04-10T18:00:00Z, Temp: 34.7C, Hum: 62.1%, Pressure: 1012.3 hPa, Status: Nominal

- Log files rotated daily or weekly to prevent overflow
- Optional compression or deletion based on storage capacity

5. Configuration and Updates

- Config file stored on SD card or updated via BLE

- Editable parameters:
  - Wake interval (1, 5, 10, 30, 60 minutes)
  - Alert thresholds (temp, humidity, etc.)
  - Logging options (frequency, format)
- Optional OTA update pathway using BLE or USB serial

6. Data Retrieval and Future Expansion

- BLE app for basic interaction and download (planned)
- SD card may be removed and accessed via PC or uploader
- Future expansion:
  - Web dashboard with chart visualizations
  - Upload pipeline for researchers to central database
  - MQTT or HTTP push from gateway (if connectivity is added)