



Sonabee

Acoustic Hive Intelligence for Early Detection of Colony Stress

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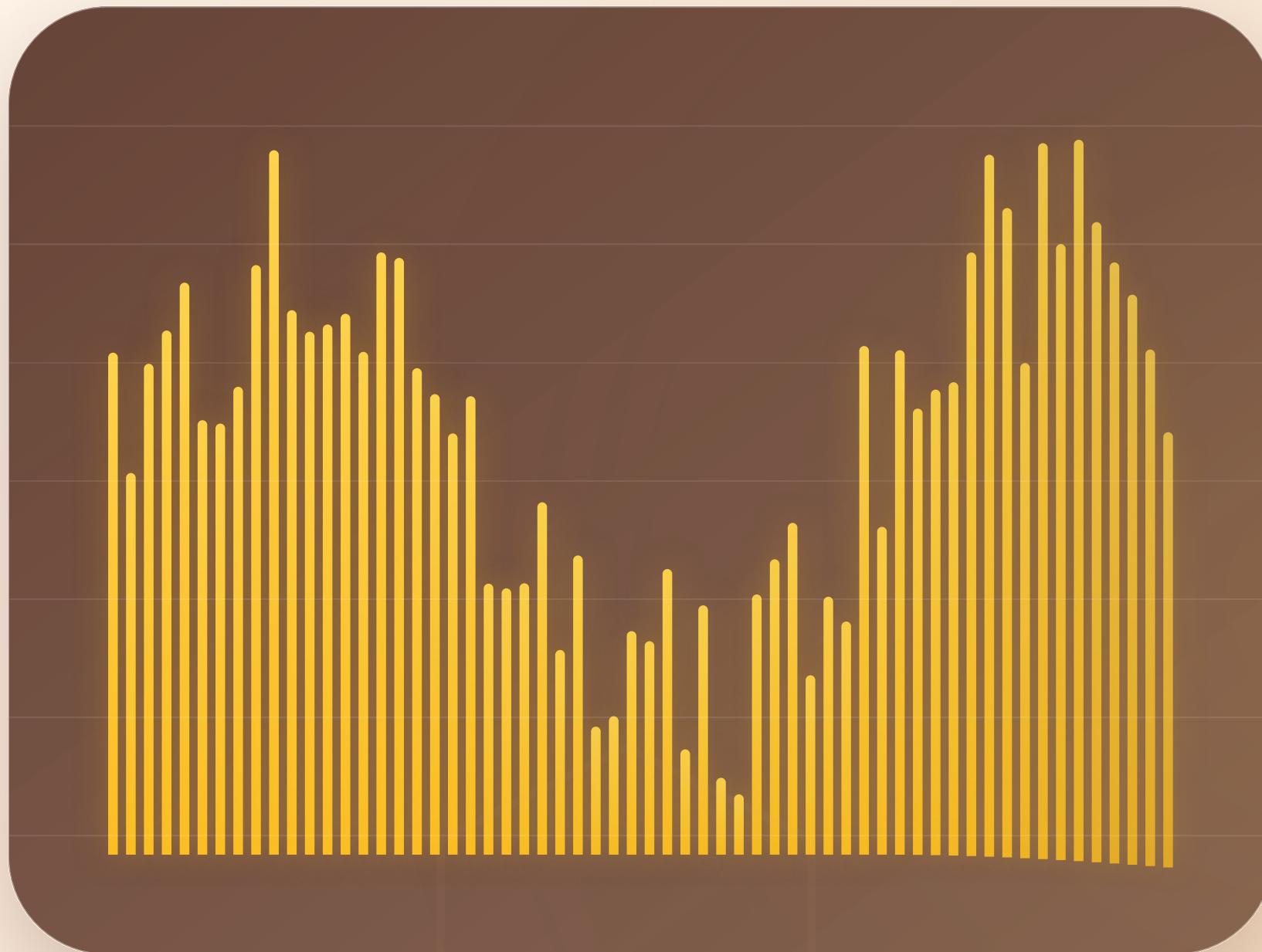
The Problem

Modern beekeepers lack real-time, non-invasive tools

- Inspections are infrequent and disruptive
- Early stress signals are subtle and easy to miss
- Acoustic patterns are diagnostic but hard to interpret

Bees are always communicating – we just haven't been listening effectively.

Why Acoustics?



Queenlessness

Chaotic frequency drift

Swarming

Elevated harmonics

Thermal stress

Increased fanning

Parasites

Irregular modulations



Introducing Sonabee

- Upload audio
- Extract fingerprints
- Classify stress
- Actionable insights
- ML + behavior heuristics

Turning colony buzz into
meaningful diagnostics

Value Proposition



Non-Invasive Monitoring

"Just sound"

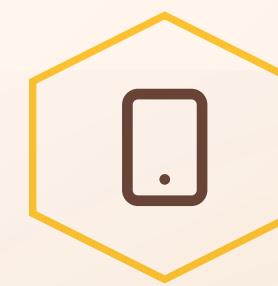
No need to open the hive or disturb the colony



Early Detection

"Before symptoms appear"

Catch stress signals before visible signs emerge



Accessible

"Phone + microphone"

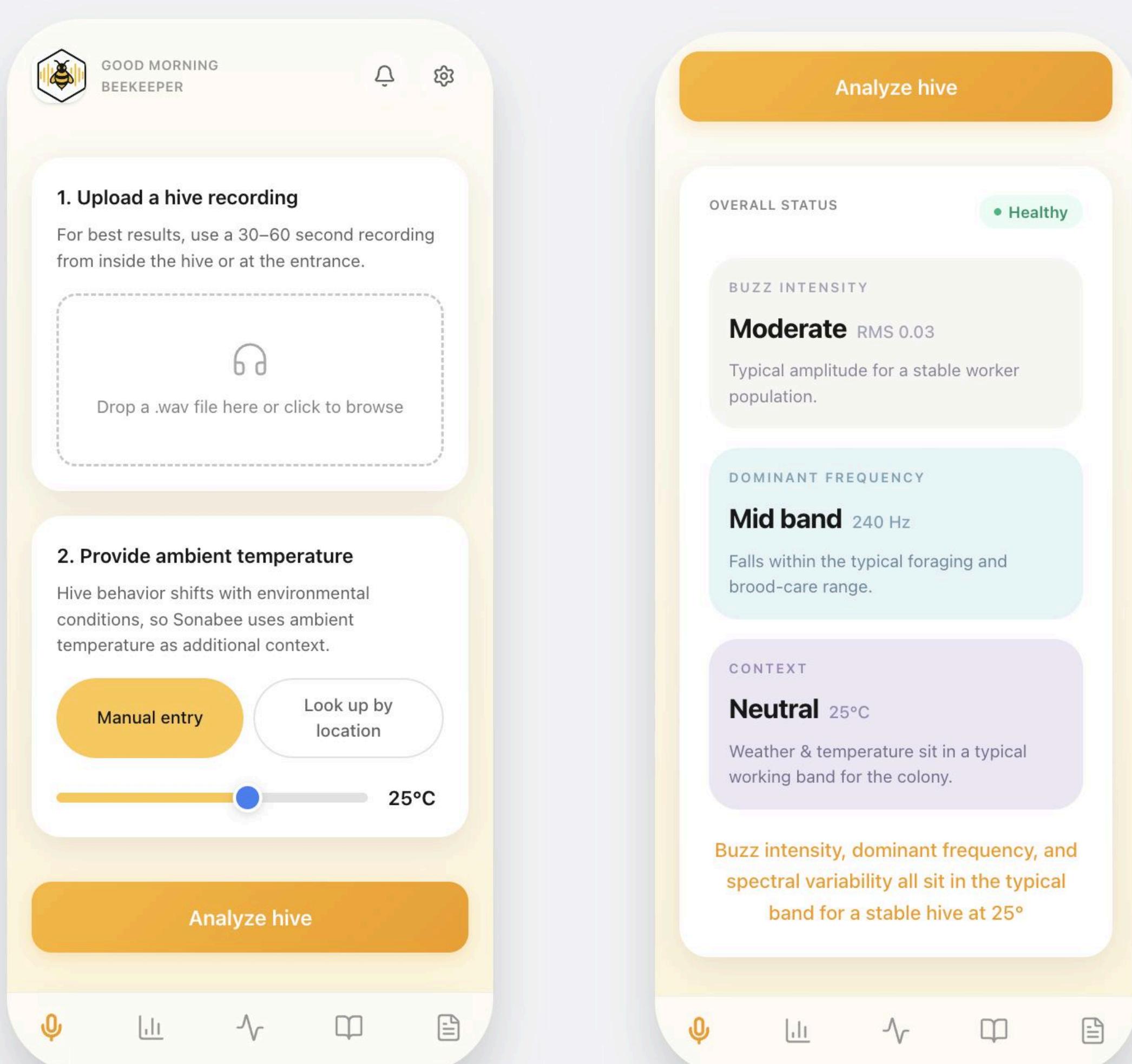
No expensive equipment required

System Pipeline

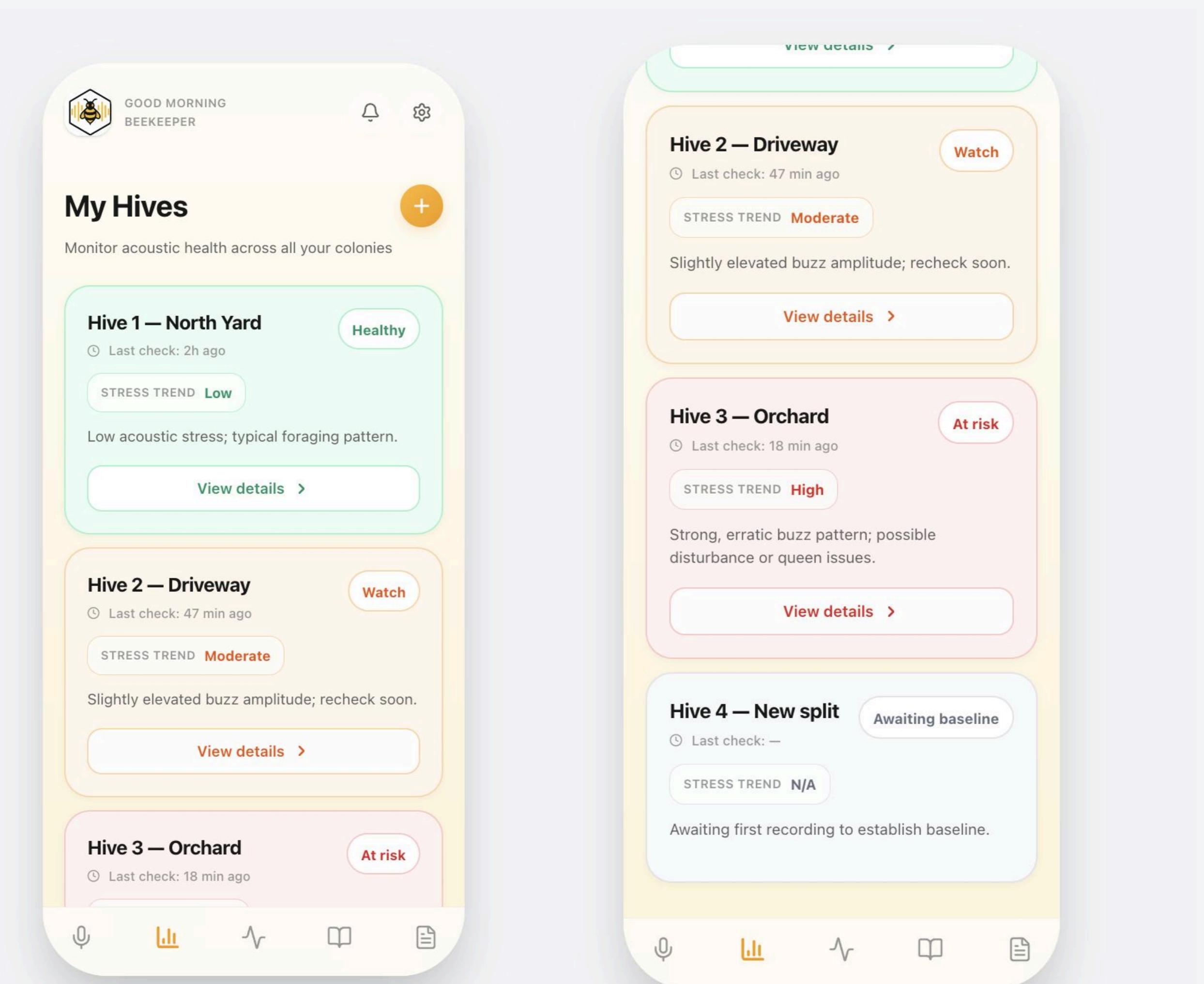


Integrates signal processing, mel-spectrogram, MFCC, temperature context, and lightweight classifier for real-time hive stress assessment

Demo Walkthrough



Demo Walkthrough



Limitations



Data Scarcity

Limited labeled acoustic datasets available for diverse hive conditions



Environmental Noise

Field recordings contain variable ambient noise that affects classification accuracy



Colony Variability

Different bee species and colony sizes produce unique acoustic signatures



Generalization Limits

Model trained on specific conditions may not generalize to all geographic regions

Future Directions



Short-term

- Noise-robust feature extraction methods
- Temperature baseline calibration
- Improved swarm detection algorithms
- Mobile app optimization



Long-term

- Reinforcement learning for personalized colony monitoring
- IoT hive sensor integration platform
- National acoustic dataset collaboration
- Multi-species acoustic model expansion

"Building towards a comprehensive acoustic monitoring ecosystem for global pollinator health"