# BeeMonitor: Smart Beekeeping Assistant

Overview:

BeeMonitor is designed to assist beekeepers by monitoring hive conditions and detecting swarming events through audio analysis.

Key Features:

- Hardware Components:  
 - Arduino Nano 33 BLE Sense (with built-in microphone and sensors)  
 - USB-A to Micro-USB Cable

- Software Tools:  
 - Arduino IDE  
 - Edge Impulse Studio  
 - Android Studio

Functionality:

- Swarm Detection: Utilizes audio analysis to identify the unique buzzing patterns associated with swarming, allowing timely intervention.

- Environmental Monitoring: Tracks temperature and humidity within the hive to assess colony health.

- Bluetooth Connectivity: Enables real-time data transmission to an Android application for remote monitoring.

Machine Learning Integration:

- Data Collection: Captures bee buzzing sounds using the onboard microphone.

- Model Training: Processes audio data into spectrograms and trains a neural network to distinguish between normal and swarming states.

- Deployment: The trained model is deployed onto the Arduino Nano 33 BLE Sense for real-time inference.

Android Application:

- User Interface: Displays real-time temperature, humidity, and swarm alerts.

- Connectivity: Communicates with the Arduino device via Bluetooth for data retrieval.

Implementation Steps:

1. Program the Arduino Nano 33 BLE Sense with the provided code.  
2. Install the Android application on a mobile device.  
3. Place the Arduino device inside the hive.  
4. Use the Android app to connect to the device and monitor hive conditions.

Future Improvements:

- Enhancing the machine learning model with additional bee buzzing data.

- Expanding Android app features for better user experience.

- Integrating LoRaWAN connectivity for remote data access.

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For detailed instructions, code, and resources, visit the full project page:

https://www.hackster.io/401089/beemonitor-96f5d7