**Project Title: Integrated Bird Habitat Monitoring and Anomaly Detection System**

**🌐 Project Overview:**

This project is a smart IoT-based solution designed to monitor both the **environmental conditions** and **positional integrity** of bird habitats or tracking devices. By combining **temperature and humidity data** from the DHT11 sensor with **location coordinates** from the NEO-6M GPS module, the system can detect **abnormal patterns** that may affect bird safety, habitat conditions, or device integrity.

Data is transmitted via **ESP32 Wi-Fi** to a central web server (using PHP + MySQL), where it can be logged, analyzed, and visualized. The system includes **real-time anomaly detection** on both environmental and GPS data.

**🎯 Project Objectives (Combined):**

1. **Monitor Key Environmental Parameters**:
   * Use the DHT11 sensor to gather real-time data on temperature and humidity levels in bird habitats.
2. **Track Physical Location of Sensors**:
   * Use the NEO-6M GPS module to monitor the exact geographical location of each sensor or tracking device.
3. **Detect Environmental Anomalies**:
   * Identify sudden or unusual changes in temperature or humidity (e.g., heat waves, cold snaps, storms, fires, etc.).
4. **Detect Movement Anomalies**:
   * Track unexpected or irregular movements of the monitoring station or a tagged bird, indicating theft, displacement, or abnormal migration behavior.
5. **Enable Real-Time Alerts and Response**:
   * Automatically alert researchers or conservationists when abnormal conditions or movements are detected.
6. **Ensure Data Logging & Long-Term Analysis**:
   * Store sensor and location data in a MySQL database for future reference, trend analysis, or research purposes.
7. **Support Wildlife Conservation & Emergency Action**:
   * Help conservationists quickly respond to potential habitat threats or bird health risks based on data anomalies.

**🧱 System Architecture Plan:**

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[ DHT11 ] [ NEO-6M GPS ]

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[ ESP32 MCU ]

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[ Wi-Fi Transmission ]

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[ Web Server (XAMPP) ]

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[ PHP Script Receives Data ]

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[ MySQL Database Stores Data ]

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[ Anomaly Detection Logic ]

- Temperature spikes/drops

- Humidity thresholds

- GPS movement deviation

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[ Alerts / Logs / Dashboard ]

**🔎 Anomaly Detection Plan (Combined Logic):**

**A. Environmental Anomaly Detection (DHT11)**

* Define safe temperature & humidity ranges based on historical data or species needs.
* Use statistical methods or ML (e.g., Z-score, Isolation Forest) to flag:
  + Sudden changes (e.g., ΔTemp > 5°C in 1 hour)
  + Extreme values (e.g., Temp > 40°C or < 5°C)
  + Sustained abnormal conditions (e.g., high humidity > 90% for over 6 hours)

**B. GPS-Based Movement Anomaly Detection**

* Log initial coordinates (reference zone).
* Monitor for:
  + Unusual speed or distance jump (e.g., moved 5 km in 2 min = flag)
  + Leaving predefined zone (geofencing logic)
  + No GPS signal for long durations

**C. Hybrid Anomaly Detection**

* Combine both datasets to find compound risks:
  + Sudden environmental anomaly **+** unexpected GPS movement ⇒ possible natural disaster (e.g., fire or flooding)
  + Abnormal temperature **+** loss of GPS signal ⇒ possible device damage
  + Good environment **+** drastic movement ⇒ possible theft or animal disturbance

**📦 Final Features to Implement:**

* 🌡️ **Environmental data logging and threshold checking**
* 📍 **GPS data logging and geo-fence alerting**
* 📊 **Web dashboard for visualization**
* 📧 **Email/SMS alert system for critical anomalies**
* 🧠 **Optional ML-based anomaly detection using LSTM or Isolation Forest (Python + Flask or Node.js for advanced version)**

**✅ Benefits & Impact:**

* Promotes **proactive bird conservation**
* Minimizes risk to equipment and wildlife
* Enables **remote monitoring** of large or inaccessible areas
* Scalable for use in forests, urban parks, reserves, and migratory bird studies

Would you like a flowchart or block diagram for this system too? I can also help with defining thresholds, database design, or integrating a simple anomaly detection script in Python or PHP.

4o

**You said:**

ok what would the alert message be?

**ChatGPT said:**