**IoT-based smart onion storage project**:

**Objective:**

* To address the abiotic factors (rotting, sprouting, weight loss, decaying) that affect onions by developing an IoT-based smart warehouse.
* The system will monitor and regulate factors like temperature (25°C to 30°C) and humidity (65% to 70%) using an IoT circuit, improving the shelf life of onions from 3 to 10 months​.

**Abstract:**

The proposed solution is an IoT-based warehouse designed to store onions under optimal conditions. It aims to prevent wastage and maintain the quality of onions by monitoring environmental factors using sensors and a microprocessor. The project will use a ventilation system. The solution is intended to benefit farmers and industries involved in onion storage and processing by reducing wastage, stabilizing market supply, and preventing price surges.

**Methodology:**

1. **Hardware Setup**:
   * **Sensors**:
     + **DHT11** for temperature and humidity monitoring.
     + **MQ135** to detect ammonia.
     + **MQ2** to detect carbon monoxide.
   * **Microprocessor**: Raspberry Pi (4GB RAM).
   * **Ventilation System**:
     + Fans and vents across the warehouse controlled by shutters.
     + Nichrome wires to blow hot air when needed.
     + Perforated flooring for proper air distribution.
2. **Data Collection & Monitoring**:
   * Sensors installed in and around the warehouse collect data on temperature, humidity, and gas levels.
   * The collected data is sent to the microprocessor, which compares it with present threshold values.
   * Based on the comparison, the system automatically adjusts the ventilation and heating to maintain optimal storage conditions.
3. **Automation & Control**:
   * The entire system is connected to an IoT cloud platform (ThingSpeak), enabling remote monitoring and control.
   * Automated systems regulate the warehouse environment to ensure all onions are stored under optimal conditions.
4. **Modifications**:
   * The warehouse will have a thermal insulation layer to protect from external weather conditions.
   * The software component automates operations and provides user-friendly remote access.

**Approach:**

1. **Research and Requirement Analysis**:
   * Study the storage conditions necessary for long-term onion storage.
   * Identify key environmental factors (temperature, humidity, gas emissions) that impact onion quality.
2. **Design the IoT System**:
   * Implement sensors and microprocessors for monitoring.
   * Design a responsive ventilation and heating system to maintain conditions.
3. **Prototype and Testing**:
   * Build a prototype using the identified hardware and software.
   * Test the system under real-world conditions and optimize it based on results.
4. **Deployment**:
   * Implement the solution in warehouses and monitor its long-term performance.
   * Make necessary adjustments based on feedback and data collected.

**Data Required:**

* **Environmental Thresholds**:
  + Optimal temperature: 25°C - 30°C.
  + Optimal humidity: 65% - 70%.
* **Sensor Data**: Continuous data on temperature, humidity, and gas emissions (ammonia, carbon monoxide).
* **Warehouse Design**: Size, ventilation layout, insulation material, and storage platform height (60 cm).