Agricultural Management System Implementation using FreeRTOS

1. Proposed Problem:

Develop a Smart Agricultural Management System to automate irrigation processes and monitor environmental conditions in agricultural fields. The system aims to optimize resource utilization, respond to real-time events, and provide efficient user interaction.

2. Resolution using FreeRTOS Features:

Utilize the FreeRTOS real-time operating system to implement task scheduling, event handling, and system optimization. Key features include:

- **Cyclic Executives:** Organize tasks into major frames with repetitive cycles to ensure timely execution of critical operations. Distribute minor frames within each major frame to accommodate various tasks and operations.

- **Task Notification:** Employ fast and lightweight task notifications to trigger specific tasks such as manage water supply based on changes in soil moisture levels or weather conditions. Ensure proper responses to environmental changes by signaling relevant tasks through task notifications.

- **Idle Hook Function:** Utilize the idle hook function to perform power-saving measures during idle periods, optimizing energy consumption in battery-powered agricultural systems. Implementation can be done between two cycles(major frames) or in a specific time of the day.

3. Tasks to be Implemented:

Main operations (Repetitive Tasks):
- **Soil Moisture Monitoring:** Continuously monitor soil moisture levels using sensors.
- **Weather Monitoring:** Monitor environmental conditions, including temperature, humidity, and precipitation.

- **Supportive Operations (Repetitive Tasks):**

- **Data Logging:** Log sensor data and system events for analysis and record-keeping purposes.
- **Low-Power Management:** Implement strategies to minimize power consumption during idle periods, such as adjusting system sleep modes. Maximize battery life in battery-powered systems to ensure continuous operation. Idle hook function can be used to implement this.

- **Other Operations (May not be repeted):**

- **Irrigation Control:** Automatically control irrigation systems based on soil moisture levels and weather forecasts.
- **User Interface Operations:** Provide a user-friendly interface for monitoring system status, viewing data, and configuring settings.

4. Notes:
- The system may require sensors but we can use flag and parameters for basic implementation.

Major Frame — **Major Frame**

repeats continuously

Task notifications

Soil Moisture Monitoring Task

Weather Monitoring Task

Data Logging Task

Low-Power Management Task

Irrigation Control Task