Title
Soil Moisture, Salinity, and Nitrate Control for Soil and Groundwater Protection in Support of Wireless Sensor Networks and Optimal Irrigation Strategy

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**Introduction:** Reclaimed Water is Reused for Agricultural Irrigation in California

**Problem Description:** Contaminant Control is Necessary for Pollution Prevention

**Proposed Solution:** Automatic Feedback Control Scheme with Wireless Sensor Networks

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**Soil Moisture Control in Palmdale**

- Soil moisture control was performed in May 2007.
- The objective of irrigation control was to determine the application rate such that soil moisture level at 5cm is maintained under 22% while maximizing reclaimed water usage.

**Salinity and Nitrate Control in Merced**

- Salinity and nitrate in soils are controlled in Merced such that salinity and nitrate level at certain depth are maintained under threshold value while maximizing reclaimed water usage.

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**Soil Moisture Control in Palmdale**

- A control algorithm is required to maximize the reclaimed water input while protecting groundwater.
- Real-time parameter estimation for the simulation models is executed using on-line data from sensors.
- Novel multi-level sensing stations (pylons) are deployed at varying spatial densities over a portion of a 30 acre test plot.

**Merced “Backyard” Test Bed**

- A test bed for salinity and nitrate control is set up in Merced.
- An Automatic irrigation control system is used to adaptively autonomously manage the flow rate using a feedback-control simulation-optimization program.
- Multi-level sensing stations (soil moisture, temperature, salinity, and nitrate sensors) are deployed to monitor soil conditions in 1-D.

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