INITIATING SCADA PROJECTS IN IRRIGATION DISTRICTS

USCID Water Management Conference

Meeting Irrigation Demands in a Water-Challenged Environment
SCADA and Technology: Tools to Improve Production

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Project based upon work supported by the Cooperative State Research, Education, and
Irrigation District Engineering and Assistance (IDEA) Program

- Funding is through the Federal Legislative Initiative: *Irrigation Water Conservation in the Rio Grande Basin (Rio Grande Basin Initiative, RGBI)*
- RGBI covers the entire Rio Grande Watershed in New Mexico and Texas
- Involves multi-facet research and extension programs in all areas of irrigation
- Conducted by the Ag Programs of New Mexico State Univ and the Texas A&M System
Irrigation District Program

- Seeks water conservation through irrigation district renovation and modernization
- Involves education, applied research and demonstrations

http://idea.tamu.edu
Objectives of Irrigation District SCADA Demonstrations

- Create in-house capacity in canal operation and control concepts, and automation applications

- Demonstrate cost-effective and alternative technologies for SCADA

- Assist districts in designing/implementing projects which have a water conservation/management purpose

- Evaluate and advise districts on equipment/software options and other technical issues
Automation/Telemetry Benefits

Real time data at a central location for improved operation of system
And the ability to quickly respond to changing situations

• Reduces losses due to spillage
• Improves conveyance efficiency
• Better customer service (added flexibility)
• Improved water delivery to farm turnout which contributes to better on-farm efficiency
Remote Monitoring, Control and Automation Demonstrations

• Discussions and plans formulated with about 7 districts on projects
• Only 3 have been fully implemented for various reasons
Automation and Telemetry Demonstrations

- Hidalgo County Irrigation District No.6 (HCID6)
  - “full” SCADA project
- United Irrigation District
  - Uses less-costly equipment for remote control and automation
- Cameron County Irrigation District No.6 (CCID6)
  - Simple, low cost remote monitoring
United Irrigation District

Initial Work

• Replacement of old, manually operated gates on a main canal with a radial gate

• Move the district to flow-based system management
United Irrigation District

- Uses Campbell datalogger and direct connection to master station (computer) in district office across the street
- Initially set up for remote control from District office
- Control algorithms modified for automation
Flow Monitoring

- User interface customized based on input from district staff
- Includes flow data, gate openings, and upstream-downstream water levels
District and Online Displays in United

Radial Gate: **Past 20 min Averages**
Last Record: 5/13/2010 12:00:00 PM

- **Flow Rate**: 53.6 CFS
- **Downstream Water Level**: 4.9 ft
- **Gate Opening**: 1%
- **Upstream Water Level**: 7.4 ft
District and Online Displays

Flow (CFS) and Water Levels (ft): Past 12 Hours

- Yellow line: Upstream WL
- Cyan line: Downstream WL
- Red line: Flow (CFS)
District and Online Displays

Flow (CFS): Past 7 Days

05/08 12:00 AM 05/10 12:00 AM 05/12 12:00 AM
Hidalgo County
Irrigation District No.6

- Full automation with remote control options of gates controlling main canal and reservoir system
- SCADA Pac – base system with radio telemetry to district office 30 miles distance
- Purpose:
  - Prevent flooding of area neighborhoods during rain events
  - Improve system management
Walker Lake
HCID6 Online Access

LogMeIn - Windows Internet Explorer


LogMeIn

Now connected to
Mission 6 Computer

Please enter the computer access code:

********

Login  Cancel  More >>

The host computer keyboard and mouse have been inactive for 11 minutes

Initiate Chat with User after login.
District Lake

Control Type: Manual
Current Water Level: 131.7 feet
Remote Control: 0
Communication Status: Healthy, Multidrop

Emergency Level: 132.20 feet
Gate Status: 100

Water Level Graph:
- Overrange

Trace Type Ruler Value
- District.Current Water Level Current -

Main Menu
**Emergency Gate**

**Control Type**: Normal State  
**Current Water Level**: 132.0 feet  
**Emergency Level**: 132.40 feet  
**Communication Status**: Healthy, Multidrop  
**Gate Status**: Gate Closed

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**Water Level**

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<tr>
<th>Trace</th>
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Los Fresnos Irrigation District

- Remote monitoring of flow in main canal
Los Fresnos
Irrigation District

Uses simple, inexpensive equipment/software and telephone communications
Results

- real-time flow data access in the district office
- web-based flow monitoring system where water use can be accessed through internet
For the HCID6 Project Paper in Proceedings

• *Describes the decision process for selection of the following hardware/components:*
  – PLC (programmable logic controller)
  – Water Level Sensors
  – Communication System
  – Operational parameters
  – Programming language for PLC
  – HMI (human machine interface, i.e. SCADA display software)
For the HCID6 Project Paper in Proceedings

- *Describes problems encountered and devised solutions during installation/implementation:*
  - Line-of-sight analysis
  - Control logic programming
  - Testing of system
  - Training of district personnel
Lessons We Learned

Paper provides details on

• Need for proper evaluation of existing equipment before proceeding to next task
• Understanding the use of the programming language
• Ordering proper equipment (i.e. lightening protection, actuator components)
• Proper planning out the installation of equipment
• Establishment of suitable line of sight for radio telemetry system
• Importance and difficulty of calibrating actuators and water level sensors
Lessons We Learned

Project delays resulted due to the district’s:

• Not installing the equipment as provided in project plans
• Lack of understanding and seeing the overall project goals
• Lack of understanding on the cost, time and effort needed for each project component
• Not understanding the importance of being involved on all aspects of the project,
Implementing SCADA in Irrigation Districts

• Many problems are encountered!
Major Difficulties & Obstacles in Working with Districts

- Lack of knowledge about technologies
- In general, lack of willingness to learn/use new technologies
- Board of Directors reluctant to spend money
- Failure to commit sufficient time and effort as required
Major Difficulties & Obstacles in Working with Districts

- Lack of understanding of how their distribution network operates
- Unexpected infrastructure problems
- Desire to use existing (often unsuitable) equipment, computers, facilities
- Failure to implement routine maintenance program
- Once implemented, districts often do not use the new technologies fully
- Etc.
Weir at Los Fresnos
What’s Next?

• Development of a Guide for Districts on implementation of remote monitoring, control and automation projects

• The goals of the guide:
  – Help facilitate the successful implementation of such projects
  – District managers and directors can be aware of the decisions that must be made and the potential difficulties
10 Steps to Implementation of Projects

1) Defining the goals and objectives of project
2) Determining operational parameters
3) Developing and agreeing on design and equipment specifications
4) Obtaining Directors approval
5) Ordering and receiving equipment
6) Site modification & construction; equipment installation and testing
10 Steps to Implementation of Projects

7) Development of easy-to-understand instructions
8) Training district personnel on equipment use and maintenance
9) Constant re-enforcement of project goals to keep the district motivated
10) Arrangements/training for on-going maintenance
General Observations

Step 1: Defining goals and objectives of project goal

- Districts often don’t know where to begin or what the potential benefits are of specific types of projects
- Lack of knowledge or understanding how their system operated
  - Takes multiple meetings for them to understand what the potential options are
  - A series of creative questions may be needed them to describe how the system is currently operated
General Observations

Step 2: Determine operational parameters

- May not know basic information such as current daily operational flow rates and water levels
- Understanding the actually operation of the structure (gate adjustments) and canal system
- Field data collection is likely
- May be slow to provide necessary field support
Implementation Steps & Obstacles

Step 3: Finalizing/agreeing on design and equipment specifications

- Often, detailed explanations must be provided for each component
- Alternative and low cost equipment options may need to be specified with explanations on advantages/disadvantages

Step 4: Obtaining Board of Directors approval

- Mistrust in technology can delay decisions or require multiple meetings for discussion
- Unwillingness to spend money
- Fearful of change *(things have always been done like this)*; negative unexpected effects
General Observations

Step 5: Ordering and receiving equipment

- After approval, district may question costs and demand less expensive options
General Observations

Step 6: Site modification and construction; equipment installation and testing

- Gates and existing components may not be operational, causing un-expectant problems and delays
- Districts often want to do construction/modifications themselves to save money
- But may change and not follow the agreed design
Accurate gate calibration is pivotal for flow calculations. The gate is used for flow control and measurement purposes.
Recommended Activities for Consultants

7) Development of easy-to-understand instructions/manuals

8) Training district personnel on equipment use and maintenance

9) Constant re-enforcement of project goals to keep the district motivated
General Observations

Step 10. On-gong maintenance

- Districts will often want to do routine maintenance themselves to save money
  - But may lack skilled workers who are able to learn how to do it
Your Experiences?

If interested in collaborating on a
“Guide to Implementing Remote Monitoring, Control and Automation Projects for Irrigation Districts”

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