

Vista Data Vision Case Study: A Data Distribution System for Civil Engineering Research and Education at the University of Illinois of Urbana-Champaign

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During the 2007-2008 academic year grants were awarded to Dr. Praveen Kumar and Dr. Art Schmidt in the Department of Civil Engineering at the University of Illinois, to implement a new data collection system on the Urbana campus. The goal of this project is the deployment of sensors to provide high-resolution, semi-realtime datasets for research and education. The resulting data is published in semi-realtime over the campus wireless network and Ethernet, using Vista Data Vision at a departmental website (irbho.cee.uiuc.edu/vdv/VV_Frame.php). This VDV-powered website makes the data available to instructors and students in the classroom, allowing the visualization of campus weather events and their effects, and comparison with past weather events. The data is also used by graduate students to research green roofing technology and the impacts of climate on Midwestern hydrology and agriculture.

The Business College at the University of Illinois recently opened a new LEED-certified Business Instructional Facility (http://www.business.illinois.edu/instructional_facility/green-facts.html/) featuring a “green roof”. Green roofs are a technology which promises to transform the practice of sustainable design for large buildings, by 1) reducing stormwater management costs by absorbing and evaporating water during rainstorms, 2) reducing summer cooling costs using plants to absorb solar energy, and 3) reducing urban heat island and pollution island effects by increasing urban vegetation coverage. However, the advantages of green roofing must be researched, to improve future roofing methods and quantify the value of the technology. A pair of instruments on the Business Instructional Facility will help answer these research questions, by comparing a green roof with a traditional roof in the same location. Rain gages, solar energy sensors, runoff gages, and evaporation sensors are monitored by a Campbell Scientific CR1000 datalogger and published using VDV over the campus Ethernet.



Site Locations: (left) Business Building Green Roof, (center) Business Building Hard Roof, (right) South Farm Flux Tower

The South Farms at the University of Illinois’ Urbana Campus are a world-class agricultural research facility covering several thousand acres of prime Illinois farmland just south of the campus. These farms house studies of plant breeding and genetics, agricultural sustainability and productivity,

and bioenergy, including the \$500M Energy Biosciences Institute partnership between BP, Berkeley, and Illinois (<http://news.illinois.edu/news/07/0201bp.html>). The University's campus network has been extended to cover the entire farm facility using an 802.11 standard wide-area wireless network, broadcast from a tall radio tower at the livestock barns. This network allows the use of inexpensive, off-the-shelf wireless equipment to connect instruments and computers directly to the campus network, achieving robust broadband throughput for stable transmission of large volumes of data.

A directional wireless antenna connects an array of instruments over a 1.5 mile distance to the wireless gateway at the tall tower. A Lantronix WiBox provides the IP interface for a Campbell Scientific CR1000 datalogger, which collects a full suite of measurements from the farm fields. Measurements include the surface energy balance, fluxes of carbon dioxide, water vapor, and thermal energy, air temperature, wind speed, and rainfall, and soil water content, temperature, and energy flux. This data is used in the classroom to study the modeling of the climate and land surface in Midwestern agricultural watersheds. In addition, the high-resolution data collected by the sensors (at intervals of less than 1 minute) allow the study of this ecosystem's behavior in great detail.

Data from both sites is currently being collected by a single web server running Campbell Scientific's LoggerNet software, and published on the web in semi-realtime at a 30 minute resolution using VDV. This successful project demonstrates that high-quality web-based publication of semi-realtime sensor data from an array of locations can be achieved at a surprisingly low cost (roughly \$3000), when implemented over an existing wireless or Ethernet network, using VDV. Questions may be directed to the authors, POC: Benjamin L. Ruddell, bruddell@gmail.com.

Hydro South Farm Tower [sensors]: Overview

