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Two Kansas colleges engineer a bird's-eye view of exotic wildlife — and set the stage for a wireless community.

Karen D. Schwartz

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In the wetlands of Kansas, a Web cam tilts and pans 24 x 7, tracking wildlife in its natural habitat and positioning a community to make the most of modern technology.



With the initial Web cam operational, the goal is to erect additional towers and add more cameras and communications links from wetlands sites, say Cheyenne Bottoms Field Supervisor Karl Grover (left) and Barton IT Director Charles Perkins.

Photo Credit: TRAVIS HEYING

Academic institutions, government agencies and industry collaborated to launch the wireless initiative in the 41,000-acre Cheyenne Bottoms wildlife refuge — an internationally recognized marsh that is the largest in the mainland United States and the most important shorebird migration point in the Western hemisphere, according to ornithologists.

Using a wireless setup linked to Barton County Community College in nearby Great Bend, the Web cam tracks the movements of the hundreds of species of birds and animals — some of them endangered — that visit the wetlands each year.

A corresponding Web site (bartonccc.edu/videos) is up and running, but occasionally experiences some glitches. A January blizzard knocked out the power supply to the camera and the site was down for a few days while Charles Perkins, Barton's information technology director, worked to install a replacement power supply at the remote site.

"The main goal of this project is to enable people to view the wildlife in central Kansas and to allow for cost-effective research on the central Kansas wetlands," says Perkins.

That goal will be fully realized when the Kansas Wetlands Education Center opens in the summer of 2008 on the grounds of Cheyenne Bottoms. Perkins has worked with David Schmidt, director of computing and telecommunications at Fort Hays State University in Hays, Kan., to manage construction of the center, which will have wireless connectivity available to students, teachers and researchers. The facility will be part of the Kansas Department of Wildlife and Parks.

All Together Now

Initially, Perkins enlisted the aid of Cheyenne Bottoms Field Supervisor Karl Grover to install a wireless receiver on the college's water tower. Grover oversaw construction of a power pole and connection of a transformer to an existing Web cam, while Perkins obtained a \$50,000 R&D grant from Kan-ed, a network for broadband connectivity operated by the Kansas Board of Regents.

"The project made a lot of sense to us," says Kan-ed R&D Coordinator Randy Stout. "We look for projects that are innovative and forward-thinking. This project met those goals; it served many communities of interest and fostered collaboration."

Perkins had to get permission from state and federal agencies to install the towers and other networking components on government land.

Because of the project's research focus, Fort Hays won a \$10,000 grant from Kan-ed. Working through its auxiliary Sternberg Museum, the school is implementing the technology and telecommunications infrastructure that will enable two full-time employees to run the facility.

Barton County Community College is responsible for back-end communications, which include building and maintaining a wireless network connection that provides access to Kan-ed, as well as data, multiple cameras, video, research sensors and Voice over Internet Protocol telephones from the Barton campus to the Wetlands Education Center.



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Building a Wireless Community

The project began with the installation of a 190-foot tower on the Barton campus in Great Bend to handle line-of-sight and point-to-point connections up to 30 miles apart to nodes in the wetlands at Camp Aldrich and the education center and to provide a link to the campus' backbone network.

The project was running so smoothly — and the implementation so painlessly — that Perkins decided to make greater use of it. Kan-ed agreed to fund another tower at Camp Aldrich, a remote, isolated conference center 13 miles from campus. The college rents it out to groups. Camp Hope, a program for children with cancer, has leased it for the past 25 years.

“The kids from Camp Hope would like to be able to send their parents e-mail, and parents would like to be able to check on their kids' health and welfare,” says Mark Dean, Camp Aldrich physical plant director. “And when we have big groups come in, they want to be able to access the Internet on their notebook computers, so we had to find a way to marry the rustic with the modern.”

Using the bandwidth connection from the Barton campus, which will communicate with a second tower being installed at Camp Aldrich, those goals — and many others — can be met.

Barton's Perkins plans other projects; one is targeted at K–12 students. The local zoo, which is building a new raptor center and several classrooms, will receive a wireless signal across Great Bend from Barton. That implementation is a challenge, Perkins says, because it crosses a city that has numerous wireless signals, and Barton has to ensure that its wireless network does not interfere with police, fire or other government departments.

“As a community college, we're here to help serve the community, so we need to promote things that enhance our community and provide opportunities to our students,” Perkins says.

What started as a small wildlife Web cam project has grown into a network of technology and opportunities for students of all ages, wildlife enthusiasts, researchers, campers and others.

“Now that we have the Web cam, we can do so much more,” says Gillian Gabelmann, Barton's vice president of instructor and student services. “We're working on a wildlife degree program with Fort Hays State University, for example, and we've been able to show our students the whooping cranes, an endangered species, without leaving the campus, and without taking up an entire class period.”

This wireless initiative also sets the stage for further creative projects making use of the interactivity and connectivity developed for the Wetlands Education Center. “We've hardly tapped its potential,” Gabelmann says.

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Web cams on Campuses Elsewhere

Use of Web cams by colleges and universities — as well as by the occasional K–12 school system — is on the rise.

There are now available better-quality, lowercost cameras and accompanying software to control and monitor sites from computers and cell phones.

While many colleges and universities have caught on to the benefits of making student campuses available to prospective students and others via Web cams, relatively few have expanded the use of their Web cams to other projects that benefit students and the public.

Among those who've taken the leap:

- Michigan Technological University in Houghton, Mich., has adopted some lofty goals. The school is working with Keweenaw Volcano Observatory to provide scientific and educational information to

The Whooping Crane

One of the rarest creatures in the world, with fewer than 250 of the endangered species alive worldwide today, the cranes make frequent stops at Cheyenne Bottoms on their southward fall migration. The birds breed from about age five and live for up to 24 years in the wild. Other than during migration, whooping cranes rarely fly and fly just far enough to reach new feeding areas. They are named for their sound, a loud whooping, which is most prevalent in the morning, during courtship and when they are upset or alarmed.

The Blue-Winged Teal

A common type of small duck — the most prevalent at the Bottoms, especially during the fall migration. Blue-winged teals are early migrants, arriving in the wetlands in September and October. Blue-winged teals fly in small flocks, turning in unison. It is relatively easy to tell males from females: Males have a large white crescent on the front of their faces and a white patch on their rear flanks, while females are a dull graybrown. The male's call is a loud, high whistle, while females emit loud, evenly

the public.

- The U.K. Derby College has a proactive initiative at its Broomfield Hall campus. The college is working with local government to set up two Web cams, one overlooking bird tables and the other overlooking a site where kestrels (a type of falcon) nest.

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spaced quacks. They begin courting in the spring, and the male stands guard at a pond while the female is incubating her young.

The Mink

This small, predatory, secretive mammal thrives near water, rivers, lakes, streams and ponds or marshes, where there is reasonable vegetation and abundant prey. It is an aggressive predator, sometimes attacking animals larger than itself. Food sources are mice, rabbits and muskrats. A mink's lifespan is one to four years. They are active during the day, and inactive at night. Minks themselves are food for owls, coyotes and cats. They travel long distances, covering the entire area of the wetlands.

Putting It All Together — Wirelessly

The heart of Barton County Community College's wireless Web cam system lies at the main campus in Great Bend, Kan. A 190-foot tower handles line-of-sight backhaul connections up to 30 miles apart, line-of-sight connections between access points and subscriber module links up to 10 miles away.

The tower — purchased with a grant from the state-run Kan-ed program — is connected via fiber to the main campus' 1-gigabit fiber backbone network. Located on the tower are two 5.7-gigahertz Motorola Canopy Broadband Backhaul Modules that allow point-to-point throughput of 14 megabits per second and can withstand winds of 118 mph. One module is aimed at Camp Aldrich, and the other is pointed toward the Wetlands Education Center, which is under construction. A third Canopy module, with 6.5Mbps throughput, points toward Cheyenne Bottoms.

The Canopy access points have private Internet Protocol numbers and use Power over Ethernet (PoE) from an industrial switch at the bottom of the tower. At Camp Aldrich, a second 150-foot tower with another backhaul module allows communication with the tower at the Barton campus.

So far, Barton has set up one Web cam — at Camp Aldrich. Mounted on a 30-foot utility tower along with a subscriber module, the Sony NTSC SNC-RZ30N wireless network camera has a built-in Web server. Barton intends to erect similar tower setups at a second Camp Aldrich location, at the education center and at Cheyenne Bottoms.

To protect the college's main systems, the Web cam infrastructure uses virtual local area networks that have a separate interface to Barton's firewall. Through the use of the VLANs, the systems team can manage wireless infrastructure like one network.

As the project grows, Information Technology Director Charles Perkins expects that the wireless system will require a redistribution of bandwidth for some of its Web cam links. He says Barton can move existing backhaul modules to low-bandwidth locations and buy new modules to take on high-bandwidth loads. Perkins estimates the current equipment will last well beyond 10 years and will be replaced only as necessary.

The Bottoms: Not Just Any Old Marsh

The 41,000-acre Cheyenne Bottoms is the largest marsh in the interior of the U.S. — and a major fueling stop for migrating birds. It's on the main migration route between winter havens in South America and breeding grounds in Canada. Wildlife experts consider it the most important shorebird migration point in the Western hemisphere.

Roughly 45 percent of the North American shorebird population stops at the Bottoms during spring migration. At least 320 species of birds have been recorded — and it is a critical habitat for several threatened and endangered species, such as whooping cranes, peregrine falcons, least terns and piping plovers. As a result, it has been designated by treaty as a "Wetlands of International Importance."

Raccoons, deer, beavers, muskrats, mink and a variety of reptiles and amphibians also make their homes in the Bottoms.

