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STREET EDITION

UC'S NOT-SO-SECRET GARDEN



NICK LAMMERS — Staff

Ken Goldberg's expertise in robotics led to the creation of a robot-controlled garden in Austria, nurtured by Internet users.

Robots grow real garden online

Berkeley lab controls planting in Austria

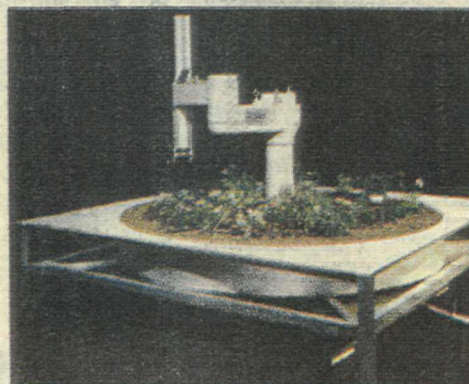
By William Brand
STAFF WRITER

BERKELEY — In its short existence, the World Wide Web has sprouted some odd things, but there's a Web site in Austria controlled from a University of California, Berkeley robotics laboratory that truly boggles the mind.

It's called Tele-Garden. But this is no mythical cyber site.

It's a real garden in a 6-foot-wide, circular planter with an industrial robot arm and a camera in the center, residing currently in the lobby of the Ars Electronica Center in Linz, Austria.

This may be the strangest garden that



The 6-foot-wide Tele-Garden is in the Ars Electronica Center in Linz, Austria.

ever was. Visitors can log on, choose a seed and direct the robot to plant it. Then they can return day after day to water their plants.

It's also no doubt the first garden in the

world that's experienced an attack by a computer hacker, says Ken Goldberg, the UC Berkeley robotics wizard who hatched the idea, along with Los Angeles artist Joseph Santarromana.

Goldberg is an associate professor who in 1995 at age 30 was named a Presidential Faculty Fellow by the National Science Foundation, which included a \$100,000 research grant. He's been working in robotics for 10 years.

"We wanted to create the software necessary to allow the simple mouse-click commands available to users of Web browsers like Netscape Navigator to control the robot," he said.

The project succeeded beyond anyone's wildest dreams. More than 2 million people have visited the garden since it went online in summer 1995.

Anyone with a Web browser can log

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Garden: Planting carries responsibilities

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onto the site at: <http://telegarden.aec.at>. After some instruction and exchange of e-mail addresses with Goldberg, visitors can enter the garden by clicking a computer mouse.

The mouse click keys a live picture of the garden with its growing plants. Eventually, visitors can choose a seed, direct the robot to pick up the seed, find a tiny patch of unplanted earth, drill a hole, drop the seed in and cover it.

But with planting comes responsibilities, says Goldberg. You've got to come back on a regular basis and water your plant. The computerized robot remembers precisely where each seed is located, so finding individual plants is easy.

Thousands of people all over the world have been returning day after day to direct the robot to water their plants. That's where the robotics experiment ends and human interaction begins.

Goldberg says he was interested in making the Web more human — so he chose a garden. In an earlier experiment, Web users could log on and direct a robot to dig up artifacts. Goldberg said the garden proved much more attractive.

"A garden is a metaphor for basic human things," he said. "It goes back to neolithic times when the agricultural revolution freed people from hunting and gathering. People could start becoming poets and artists. Agriculture paved the way for changes in our culture that lead up to the present day."

Besides, the idea that someone can reach halfway around the world and complete a physical, human task like planting a seed is amazing. Although there's no physical touch or feel, being able to see a plant grow touches deep feelings.

Capitalizing on the attraction, the designers created a village commons in the center of the garden. Click on the button and it's possible to exchange live messages with others there.

A tight little community emerged as a result. Members drop in regularly to chat and make sure the garden is prospering — sometimes arranging for someone else to water their plant while they're away — and just to talk.

One of those is UC Berkeley chemistry graduate student Chris Chapo, who first visited the site while he was a student at the University of Florida, Gainesville.

"Somebody I knew said, 'You've just gotta look at this site,'" Chapo explained. "I just keep coming back. I think it's pretty cool. I don't have time to waste on regular computer chat lines, but through the Tele-Garden I've met people who seem really interesting. You don't have to worry about profanity — it's more of a community than a chat line."

"Wow," says Connie Elkhouri in a message to the garden. "This is the coolest thing I've ever seen. Not just gardening, but also computer robotics. This is the most creative use of the Internet that I have ever seen. So the Internet is good for something. Hah."

No one who has met in the garden has married so far, Goldberg says. There has been one wedding toast, he said. Everyone entered the garden from all over the world at a prearranged time and toasted the bride and groom.

Initially, the garden was in Goldberg's lab when he worked at the University of Southern California. That's where the hacker found it.

"We found that over one weekend someone had watered the garden 10,000 times. Water leaked out of the planter into the lab and shorted out our computers."

Team members discovered someone had clicked the watering command 10,000 times.

The site had become so famous among technical types that a new electronics center in Austria asked to host it. It was moved there in 1996.

The project won Goldberg and his team praise from robotics experts. A spokeswoman at Adept Inc., the San Jose robot manufacturer that donated the robot, said the use ranks among the most unusual. "Our robots are even used to sandwich the chocolate and vanilla portions of Pepperidge Farm Milano cookies together," she said. "But the garden is even more unusual."

Besides the hacker's visit, the major problem so far has been plants.

What do you do when 6,000 people plant seeds in six months time?

The team chose a natural disaster. "We announced that a hurricane was going to sweep through the garden," Goldberg said. "We warned everybody all the plants would be removed and a new growing season would begin. We got a huge number of complaints. People begged us to send them their plants, but it was impossible."

So the hurricane swept across Tele-Garden and the earth was renewed. The garden has gone through two more seasons since the first hurricane. And like gardeners everywhere, Tele-Gardeners have learned to accept the inevitable.

Another question has been the kind of seeds. Originally the team, perhaps remembering the old Fantastiks song, "Plant A Radish, Get A Radish," chose radishes. Then they added marigolds. In Austria, the choice is the Loop flower, a native European species.

The future use of the technology of directing robots over a computer net is expanding, Goldberg said. The current Mars Pathfinder mission is an example. But as a faster Web called Internet2 emerges, the opportunities are limitless. "The idea is being considered now for remote sharing of expensive research equipment such as Scanning Tunneling Microscopes and for remote monitoring and control of factories," Goldberg says.

"One application that is being pursued by a company in Pittsburgh, Pa. is putting a tele-operated robot on the moon and allowing people to take turns moving it for \$100 a move," he says.

Goldberg's team members include George Bekey, Steven Gentner, Rosemary Morris, Carl Sutter and in Austria, Jeff Wiegley.