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WHAT'S NEXT

Transforming a Fluorescent Glare Into a Guiding Light

By ANNE EISENBERG

THEY were once the hallmark of institutional monotony. No more, though: the drab fluorescent tube has been rehabilitated.

A professor at the Massachusetts Institute of Technology has figured out a way to transform the ubiquitous fixtures in the ceilings of airports, museums, offices and factories into inexpensive data transmitters. Pass under one these revamped fluorescent lights at the airport, and it may send out not just its characteristic cold glow, but also a message that flashes on your hand- held computer screen saying: "Turn left at the next corridor for Gate A. There's a cash machine just as you reach the intersection."

To create fluorescent tubes that can communicate, their inventor, Dr. Steven Leeb, has modified ordinary fluorescent fixtures so that they beam data as well as illumination. Dr. Leeb, who teaches circuit design and other subjects at M.I.T., does this by changing one component in the fixture to produce fluctuations in the light that can be read as a digital signal. These fluctuations, imperceptible to the eye, are easily detected by light sensors that pick up the signals and pass them to processors and software that produce voice, music or text messages. The lights may be linked to create inexpensive data networks.

Passers-by in subways and shopping malls may one day use messages transmitted by such lights to guide them. Some blind and brain-damaged people have already tried out the fluorescent devices as an aid in navigating unfamiliar corridors in office buildings and hospitals.

Dr. Leeb has formed a company, Talking Lights, based in Boston, to market the new device. He sometimes demonstrates his product by turning on a circular fluorescent fixture and watching their faces as Handel's "Messiah" streams out of loudspeakers connected to the photodetector and processor. "Then people get the idea," he said.

The process of using the lights to transmit data starts with a ballast, the component of fluorescent tubes that controls the current needed to create the light. The ballast causes the vapor inside the tube to ionize many times a second, creating the imperceptible flicker. Dr. Leeb has modified the ballast to modulate the number of times per second that the light flickers.

"The ballast is what makes the magic happen," Dr. Leeb said. "We drop it in, just as we would replace a bulb."

If, for instance, the light is flickering at 40 kilohertz, or 40,000 times per second, which is standard for modern fluorescent fixtures using electronic ballasts, the modified ballast might alter the frequency slightly to create a digital 1, and then alter it slightly differently to create a digital 0, thus producing a binary datastream.

"The trick is that our ballast moves the frequency around in such a way that the light doesn't flicker visibly," Dr. Leeb said.

Inexpensive photocells on hand-held computers or earphones, for instance, pick up the change in flicker and pass this signal on for conversion to graphics, music, written messages or speech. The entire receiver packet of photocell, circuits, and processing chips runs about half the size of a pack of cigarettes, said Dr. Neil Lupton, president of Talking Lights.

The information can get to the lights in many ways, Dr. Lupton explained. If people are using the lights to

broadcast information, for example, they might use a microphone to create the signal and a wire to carry the information to each light. Or a chip could be equipped with a continual audio signal repeating, for instance, the location of a restroom at an airport. Users would hear the announcement only when they came near the lights and their receivers locked on the signal. When the lights are wired together in a network, the information can be changed by reprogramming.

Dr. David Burke, an assistant professor at Harvard Medical School and director of the brain injury unit at Spaulding Rehabilitation Hospital in Boston, is heading a project to see if Talking Lights technology can be effective in helping patients with brain injuries. The project is financed by the National Institutes of Health.

"The brain-injured can walk around, but they can't organize schedules or remember when to do things," he said. To see if the lights could alleviate these problems, Dr. Burke's group equipped the patients with hand-held computers in holsters tucked next to the patients' bodies.

There is a series of talking lights on the hospital floor, each emitting a different digital signal. Before the patients start their day, their hand-held computers are programmed with that day's schedule, along with information about the locations and signals of the lights that the patients should pass at specific times. As a patient passes each talking light, the hand-held computer recognizes the unique signal from each light and matches the patient's projected schedules with actual whereabouts.

For example, Dr. Burke said, if a patient turns up as expected at a nursing station, the hand-held device recognizes the signal from a nearby light as the correct one. But if another patient who is due someplace else shows up at the nursing station, the hand- held device recognizes that the light signal is incorrect and instructs the patient by voice prompt to go somewhere else.

At the end of the day, the staff downloads the data into a PC to analyze, for instance, how often patients need to be reminded and when the reminders tend to fail so that they can fine-tune the program. Results of the pilot phase of the project were published in the June edition of the Journal of Head Trauma Rehabilitation. The data showed that patients using the system relied less on directions from people in the hospital and got to their appointments more promptly than those without.

Dr. Burke would like to apply talking lights technology beyond the hospital, in office buildings and homes, for example. "Sometimes we can rehabilitate head-injury patients so that they can leave," he said, but they still need help. "Devices like this could remind them to take their medications, make them more independent and keep them free from institutional environments for longer periods of time."

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