

Whether it's software, processors or auto parts — hardly any consumer item is safe from piracy. According to the International Chamber of Commerce (ICC), counterfeit products result in approximately \$300 billion in losses worldwide every year, or approximately five percent of total world trade. And that doesn't include the losses and damages caused by extremely dangerous counterfeits, such as faked drugs or car parts.

In their fight against modern-day bootleggers, companies now have a tool that confronts counterfeiters with an impossible task. Biotech firm november AG in Erlangen, Germany, is using short synthetic DNA molecules for encryption purposes. Like the natural biological code that served as a model, the system involves trillions of possible combinations, which makes the DNA-impregnated security labels just about as close to being unforgeable as you can get. Together with Siemens Automation and Drives, november has developed a system that can quickly and inexpensively check the authenticity of products that carry the DNA labels. What's more, the product, which will be launched under the name "brandprotection," is scheduled to make its market debut by the end of 2002.



A security label protects products such as software that can be easily counterfeited. Hidden in a felt pad in the label are strands of artificial DNA that serve as biological markers.

Protecting Brands with Biomolecules

Genes make each person unique. Brand-protection technology from biotech company november AG works in a similar manner with products. The new technology aims to put a stop to brand piracy. Labels will carry a unique marker made of synthetic DNA, and a mobile reading device from Siemens Automation and Drives will check their authenticity.

Presenting a label measuring 1.5 x 2 centimeters and incorporating a felt pad, Dr. Andre Josten, head of Development at november, explains how brand protection works. "The system includes self-adhesive labels, a pen with a special detection liquid and a hand-held reading device. The label contains DNA, which is hidden like a needle in a haystack. Suppose a customer in a store wants to check whether a product with the security label is genuine. First, the salesperson would run the reading device over it. If a yellow LED lights up, it means the label has not been tampered with." After that, the salesperson activates the label with the pen and runs the reader over it again a few seconds later. A blue LED will light up if the label is genuine. A blinking LED indicates an error. If a retry leads to the same outcome, the label is definitely a fake.

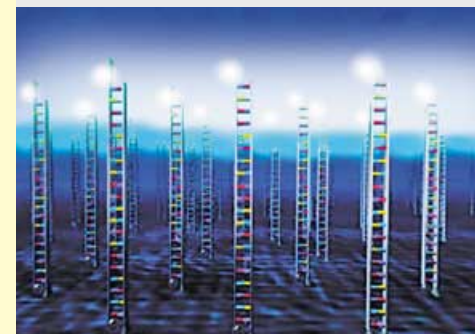
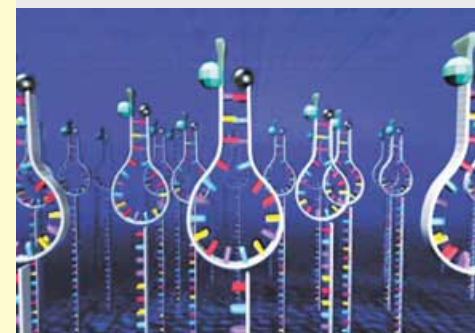
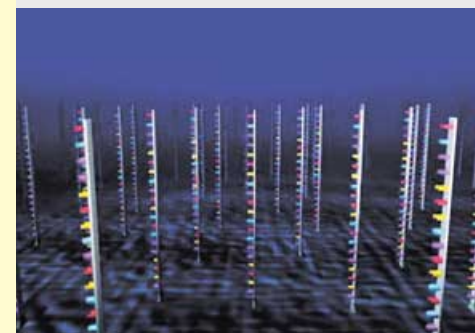
The DNA Insurance Policy

November AG's brandprotection technology is based on the ability of a DNA biomolecule to act as an information carrier. The DNA of living beings includes four constituents (bases) that are arranged like pearls on a string. Two of these single-strand molecules form a double-strand molecule: A guanine (G) is always joined with a cytosine (C), and an adenine (A) is always joined with a thymine (T). A sequence of G-A-C-G-T on one strand therefore corresponds to a C-T-G-C-A on the second strand. Researchers at november produce synthetic DNA strands of 20 to 30 bases as carriers of the encrypted information. The number of combinations this makes possible is equal to four raised to the power of x, whereby x is the number of bases. Thus, 20 bases corresponds to more than a trillion possibilities. A certain quantity of these single strands is applied to part of the felt pad in the label; the remainder serves as a reference field. The ink in a testing pen contains the counterpart strand that matches the encoding strand. This matching strand is designed in such a way that a fluorescent signal is produced when the strand from the ink and that in the label combine to form a double strand. The reading device from Siemens

Corporate Technology contains a laser that excites the fluorescent dye, causing it to glow. This signal is in turn detected by the reader. Only if the structure of the signal, including the reference field, is identified as correct does the user receive confirmation that the matching DNA strands are present and that the label is therefore genuine.

The system is forgery-proof. The DNA strands are too short — and their concentration too low — for their sequence to be analyzed with available genetic techniques. The ink and the label also contain a large number of additional strands that counterfeiters cannot distinguish from the marker strand, thus ensuring that the latter is concealed.

In addition, it is impossible to outsmart the reading device with a label that already contains the fluorescent dye, since the reading process occurs in two stages and there must be a change in the signal detected during the two measurements. Customers also have the opportunity to receive their own special DNA sequence that can be easily exchanged right away if there is the slightest suspicion of tampering.



A felt pad contains many individual DNA strands, including the one for the code (top). A testing pen provides the complementary DNA. When the strands from the pad and the pen combine (center) a fluorescent dye lights up (bottom).

"One drawback of previous techniques based on biological markers is that an analysis could only be done in a lab," Josten explains. "Our principle, on the other hand, works on site. It's also very fault-tolerant, fast and easy to use." With this system, Josten says, customers can be sure they're buying the genuine article and not a pirate copy.

This development was made possible by the combination of november's molecular-biological know-how and Siemens' experience in the fields of electronics and optics. The key idea of using DNA as an unforgeable code came to november researcher Dr. Hans Kosak five years ago during a summer bicycle trip on the North Sea island of Langeoog. Contact with Siemens was established via Manfred Hüttlinger from Moby, a Fürth, Germany-based Siemens group that specializes in identification systems (see article on page 19). Hüttlinger, who was convinced of the potential of the technique as early as 1999, recalls that "At first, our electronics specialists and biologists didn't have much to say to one another, and for a long time I fought on alone. But in the end, everyone was convinced that Siemens should invest."

Even before november's IPO, Siemens acquired a two-percent stake in the young company through Siemens Venture Capital GmbH (see article on page 76). November's COO Dr. Thomas Schulze, who is also responsible for business development, considers the partnership with a global corporation an ideal arrangement. "Siemens is a door-opener for us," he says. "What's more, we haven't had any of the problems one might expect with such a big company."

Schulze believes that global companies with customers who demand a high level of brand loyalty stand to gain the most from the new brandprotection technology. The price of the system is to be kept as low as possible. The reading device built by Siemens will cost around 1,500 euros. The labels will be produced in batches of a million and more, which means they will sell for only a few cents apiece. "Right now, studies are being conducted with potential customers who are testing the system under real conditions," says Schulze. *Norbert Aschenbrenner*