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DIY lab scanner made from standard CD drive

12:44 25 September 2007
NewScientist.com news service
Tom Simonite

Fixing two additional light sensors to a normal CD or DVD drive can transform it into a highly accurate scanner for chemical or medical tests, Spanish researchers have shown. The team has developed a modified CD drive that detected tiny quantities of pesticide in samples placed on top of an ordinary compact disk.

Biologists and chemists often detect and measure compounds of interest, such as disease pathogens in blood or pollutants in water, by triggering interactions between these compounds and known proteins and antibodies. These immunoassay tests produce further compounds that can then be measured accurately, typically using light.

However, the machines used for light detection are expensive, normally costing between 30,000 and 60,000 euros, says Angel Maquieira, of the Polytechnic University of Valencia, Spain.

Maquieira and colleagues found that an off-the-shelf CD drive can be modified to do the same job. While a laboratory machine has to precisely scan samples with light and record the results, a CD player uses similar precision to read the tiny pits that encode music or data on a disk.

"The main advantages of using a CD reader are versatility, simplicity, ease of operation, and portability for point-of-need applications," Maquieira told *New Scientist*.

Measuring light

Maquieira and colleagues soldered two extra light sensors inside a CD player, and used software to control the way the device "plays" a disk.

The first sensor identifies the sector of a disk containing a sample using black marks on the edge of the disk. The second analyses the sample itself, measuring the amount of laser light that is able to pass through the disk. The off-the-shelf disks used normally reflect around 30% of the laser beam onto the reading head, with the rest passing through.

In experiments, the researchers used their modified drive to detect traces of three different pesticides. A sample – half a millimetre across on a disk – was treated normally, using a set of reactions that produce an amount of dye or silver that is inversely proportional to the amount of pesticide in the sample.

The amount of laser light that passed through the disk to the second sensor indicated the levels of dye or silver. The modified drive was thus able to detect levels of pesticide as low as 0.02 micrograms per litre.

Although the hacked device lags behind the performance of specialised machines, it is accurate enough for many lab tasks, the team says.

High capacity

Other researchers have previously used the reading head from a CD drive to scan chemical samples. Using the whole drive is both faster and cheaper, Maquieira says.

He adds that thousands of samples could be placed on a single disk. "Currently, working at minimum capacity, we can manage 3072 dots, but the real capacity is much higher – more than 10000 per CD," he says.

Patrick Corran, who uses immunoassays at the London School of Hygiene and Tropical Medicine, says modified CD drives could be perfect for use in poorer countries. "I study malaria and I'm always aware of the importance of making equipment available to developing countries," he told *New Scientist*. "A cheap and cheerful device made from mass produced and easily available products could help with that."

However, Corran believes that the Spanish team's procedure needs to be developed further. "They still do part of the assay in a normal plate. Until the whole thing can be done on a CD it doesn't have a great technical advantage."

Corran adds that future disk drives may be even more useful, since next-generation systems like Blu-ray and HD-DVD use shorter wavelength lasers that are closer to those found inside laboratory machines.

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A couple of extra light sensors turn an everyday CD drive into a cheap, portable, chemical scanner that could replace larger, more expensive machines (Image: UPV)

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