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Photography

Going round the bend

A camera that can see around corners

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PHOTOGRAPHY can perform many tricks. Until now, though, looking round corners has not been one of them. Ramesh Raskar of the Massachusetts Institute of Technology (http://web.mit.edu/) plans to change that. He and his students, Ahmed Kirmani and Andreas Velten, have developed a camera that can see what other cameras cannot.

In standard flash photography, a bulb on the camera releases a burst of light. This light strikes objects. Some of the light then bounces back to the camera, where it is used to generate an image. Dr Raskar's device is similar, but with one crucial difference. Instead of recording light reflected directly from the object to be photographed, it records light that has been reflected several times on the journey.

As an example, a photographer taking a picture of someone standing out of sight in a room with a half-open door might aim the camera at the door. Light from the flash would be reflected off the door and onto both the person and the walls behind that person. Some of this light would then travel back to the door and be reflected into the camera.

That much is basic optics. The trick is what the camera does with the multiply reflected light once it has arrived. A computer inside the machine analyses the incoming rays and identifies which ones came back early because they bounced off the person and which came back late because they took extra time to pass the person and be reflected from one of the walls instead. This analysis allows a geometric reconstruction of where the various light rays have been, thus creating a picture of what could not ordinarily be seen.

Because the flash must survive multiple reflections without being absorbed or becoming too weak, not just any light can be used. It must be a laser. Dr Raskar and his students are working with one that fires its pulse in a quadrillionth of a second. That means the pulse is powerful, because all its energy is concentrated into such a short time. It can thus survive the absorption associated with multiple reflections. It also means that reflections from different places are easier to tell apart, because they do not blur into one another.

There is a problem with such a powerful pulse, though. Light reflected directly back at the camera, and thus not much absorbed, may overwhelm its sensitive detectors. To deal with that, the camera is programmed to keep its shutter closed until the pulse has had time to go around a corner and return.

At the moment, the new camera can produce only low-quality images, and cannot cope with objects that have several sorts of surface material. Dr Raskar reckons, though, that this is only a temporary problem. Refinements of the technique, he believes, will make it a practical technology within two years, and will open a range of applications from studying inaccessible nooks and crannies of the human body to looking into rooms and hidden corridors in burning buildings.