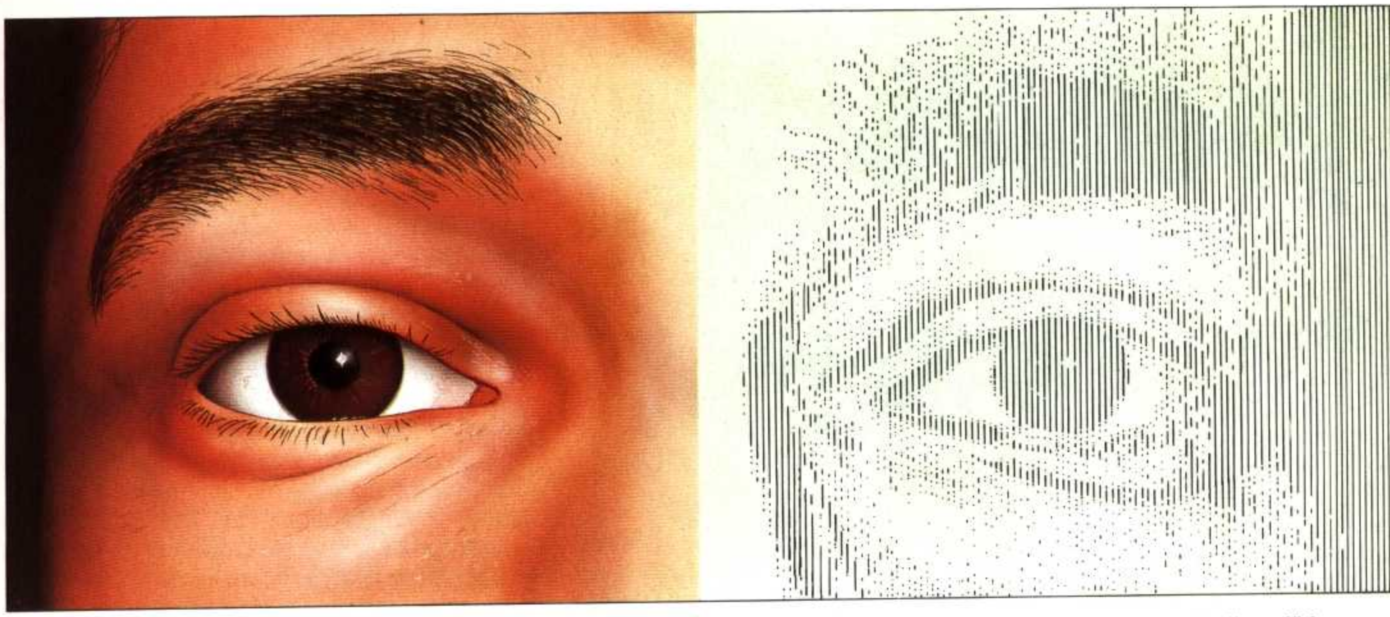
EYE ROBOT



Our investigation into the topic of robotics has now considered several different ways in which a robot may be programmed to act 'intelligently'. Here we examine the problems involved in enabling a robot to 'see' objects in the world around it.

Of all the human senses, vision is perhaps the most important. So central are visual perceptions to our understanding of the world that the phrase 'it is like trying to describe colour to a blind man' is often used to illustrate the difficulties involved in explaining a person's lack of understanding of a particular subject. Without vision, our knowledge of the world is severely restricted — and, similarly, a robot with no visual apparatus is equally handicapped. We have already seen how robots can use sensors to detect the presence of an object in their path; now we want to develop a system that will provide them with visual equipment that is as efficient as a human being.

The human eye has an iris that acts as a lens, controlling the amount of light entering it, and a retina onto which the lens focuses the image. But the fact is that the eye does not really 'see' anything at all; it is merely a transducer that converts one signal into another, more acceptable, form. The real job of seeing is carried out by the brain on the basis of the signals it receives from its sensors.

So in robot vision we can divide the subject into two quite distinct parts. The first concerns the construction of an appropriate 'eye' to act as a sensor for the robot's vision system; the second part consists of the computer processing that must be carried out before the robot can make sense of the signals from this sensor.

Constructing a robot eye is not too difficult. At its very simplest level, a photoelectric cell can act as a type of eye. This can give a signal that corresponds to the overall illumination of the field of view — as we have already seen, this can be useful if we simply want our robot to 'home in' on a bright light or to follow a white line painted on a dark background. The program to use this sensory input may also be simple because the information received is limited and there is a proportionately limited number of actions that the robot could follow as a result of such simple signals.

But we can hardly call this 'vision', in the sense that we understand the word. Specifically, we require a visual system that can build up a complete two-dimensional image of the world, enabling the robot's 'brain' to examine exactly the same information that is processed by the human brain and arrive at an answer.

One answer to this problem uses a single photoelectric cell with a lens placed in front of it. This scans the image area in front of the robot, mechanically sweeping the entire field of vision until a complete picture has been built up; the picture can then be stored in the computer's memory. In practice, unfortunately, this method is slow and unreliable.

In most cases, however, the robot eye consists of a video camera of some sort. This camera may be the standard type that is used in television broadcasting, or it may be a specialised device that is designed specifically for robotic vision. Some forms of the latter type use special chips called Optical RAMs — these consist of RAM memory in which the value of each byte is set automatically

Robot Vs. Human Vision
The nature of the human's ability to see relies very heavily on the interaction between a complex system of nerves and receptors, all processed by the brain. Although a visual image consists of patterns of light and dark imprinted on the retina, the actual 'seeing' is done in the brain. A robot's brain also processes an image of light and dark patterns, but suffers from a much lesser degree of precision