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New curvilinear camera adds a zoom to the 'human eye'

Published: Tuesday, Jan 18, 2011, 21:34 IST
Place: Washington, DC | Agency: ANI

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Researchers have developed a curvilinear camera that mimics the human eye, but has the added feature of zooming.

Scientists from Northwestern University and the University of Illinois in the US have created the 'eyeball camera', which has a 3.5x optical zoom, takes sharp images, is inexpensive to make and is only the size of a nickel.

Once optimised, the camera can potentially be used for a variety of applications, including night-vision surveillance, robotic vision,

endoscopic imaging and consumer electronics.

"We were inspired by the human eye, but we wanted to go beyond the human eye," said Yonggang Huang of Northwestern's McCormick School of Engineering and Applied Science.

"Our goal was to develop something simple that can zoom and capture good images, and we've achieved that," he added.

The tiny camera combines the best of both the human eye and an expensive single-lens reflex (SLR) camera with a zoom lens.

It has the simple lens of the human eye, allowing the device to be small, and the zoom capability of the SLR camera without the bulk and weight of a complex lens.

The key is that both the simple lens and photo detectors are on flexible substrates, and a hydraulic system can change the shape of the substrates appropriately, enabling a variable zoom.

While 'eyeball cameras' already exist, they lack variable zoom because they use rigid detectors. This camera uses a thin, elastic membrane for the sensor and an integrated lens on a water chamber, with a clear glass window underneath.

Initially, both detector and lens are flat. Beneath both the membranes of the detector and the simple lens are chambers filled with water. By extracting water from the detector's chamber, the detector surface becomes a concave hemisphere.

To achieve an in-focus and magnified image, the researchers actuate the hydraulics to change the curvatures of the lens and detector in a coordinated manner.

The shape of the detector must match the varying curvature of the image surface to accommodate continuously adjustable zoom, and this is easily done with this new hemispherical eye camera.

The research is published by the *Proceedings of the National Academy of Sciences*.



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