Infrared Retina with Meta-Infrared Detectors

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Background

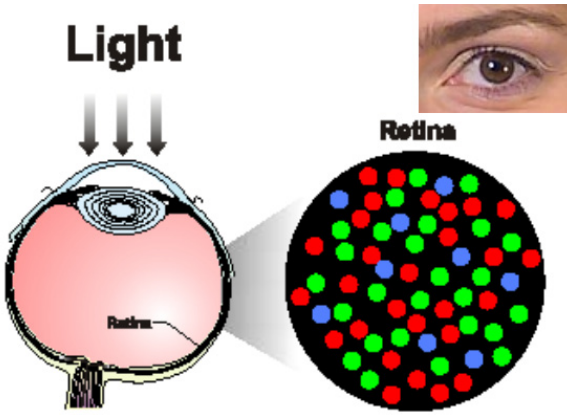
As infrared imaging systems have evolved from the first generation of linear devices to the second generation of small format staring arrays to the present "third-gen" systems, there is an increased emphasis on large area focal plane arrays (FPAs) with multicolor operation and higher operating temperature. Current technologies utilize intricate assemblies consisting of multicolor FPAs with integrated spectral filters to achieve a limited color response. Furthermore, present day multi or hyperspectral systems are bulky and expensive. The ability to obtain color images from infrared sensors is extremely advantageous in areas of remote sensing, camouflage defeating, pollution monitoring, gas leak detection, gas sensing, spectroscopy, remote identification of chemical and biological agents, as well as anomaly detection (amongst many others). There is a present market need for increased functionality at the pixel level for these next generation FPAs.

Technology Breakthrough

The human eye is a sensor that can elegantly represent a dynamic scene by extracting enormous visual information. Researchers have developed the infrared retina, which is an array that works similarly to the human eye. This technology has a "single" FPA, but multiple cones, which are photoreceptor cells in the retina of the eye that enable the perception of color. The infrared retina exploits the continuous spectral tunability of mid-infrared, nanoscale quantum dot-based sensors. The detectors sense information over different spectrally overlapping bands, similar to the cones in the human eye. In addition, the infrared retina is capable of plasmonic tailoring of the resonance or bias-dependent dynamic tuning based on quantum-confined Stark effect or incorporation of avalanche gain. This technology offers a new paradigm for infrared sensors that could provide infrared-color imaging capabilities akin to visible spectrum three-color imaging and photography.

Key Advantages

- *Ultra/hyper-spectral image response used in military applications such as defeating camouflage and remote identification of chemical and biological compounds*
- *Application in anomaly detection, which would allow users to detect targets whose signatures are different from their surroundings*
- *Spectrally, temporally and spatially tunable*
- *Extendible to other technologies*
- *Significantly reduces cost and complexity*
- *Operates without filters, gratings, or other optical components*



Intellectual Property

Issued U.S. Patent 8,071,945

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