

**Docket #:** S13-419

# **Low-Power CMOS Image Sensor for Object Detection**

Stanford researchers are developing a low-power, CMOS image sensor with embedded feature-extraction for mobile vision applications. Leveraging the fact that vision features are often edge-based, the sensor's readout circuitry digitizes ratios of neighboring pixels (representing edges) rather than absolute pixel values. As a result, scenes with wide variations in lighting can be represented with fewer bits per pixel, and 100X-1000X less power compared to commercial mobile sensors. The approach is ideal for power-constrained applications - wireless sensor nodes, phone cameras, wearable devices and unmanned aerial vehicles. The approach is also cost-effective, as it uses a standard linear pixel array. This technology could enable an "always on" camera that continuously captures features for object-detection, which in turn could extend the capability of both contextual awareness and augmented reality on mobile platforms.

## **Stage of Research**

Researchers are completing chip architecture designs and performance estimations. Chip layout, manufacture and test are the next steps.

## **Applications**

- Cameras in:
  - Mobile phones
  - Wearable devices
  - Mobile computing
  - Unmanned Aerial Vehicle Systems
- Wireless sensor nodes

## Advantages

- Low power consumption ( 250uW for entire chip vs. typical mobile cameras at >100mW)

## Publications

- Omid-Zohoor, Alex B. "[Imaging providing ratio pixel intensity](#)." Patent Application No. PCT/US2015/018002, published September 2015.
- Omid-Zohoor, Alex, Christopher Young, David Ta, and Boris Murmann. [Towards Always-On Mobile Object Detection: Energy vs. Performance Tradeoffs for Embedded HOG Feature Extraction](#). *IEEE Transactions on Circuits and Systems for Video Technology*.(2017):1.Web.

## Patents

- Published Application: [WO2015131045](#)
- Published Application: [20170064211](#)
- Issued: [10,009,549 \(USA\)](#)

## Innovators

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