



Himax WiseEye

Unlock the benefits of endpoint AI



CASE STUDY

Enabling AI at the Edge with Himax WE2 AI Processor

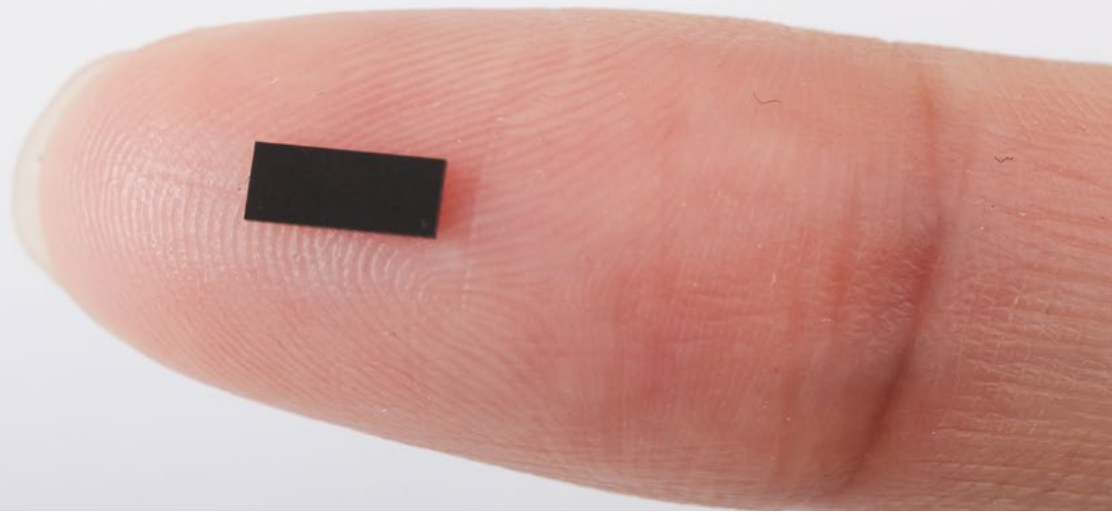


OVERVIEW

Edge computing is becoming increasingly important as more data is generated by endpoint devices like smartphones, wearables, and sensors. Performing artificial intelligence (AI) inferencing at the edge can reduce latency, improve privacy, and decrease bandwidth needs. However, edge devices have tight power constraints.

Himax Technologies has developed an ultra-low power AI processor called WiseEye 2 (WE2) to enable edge AI inferencing in power-constrained devices.





Challenges of Edge AI

Performing AI inferencing on endpoint devices is challenging due to the limited memory, compute, and power available. Most AI accelerator chips rely on external DRAM, which increases cost and power consumption. The WE2 overcomes these limitations with an innovative architecture.

Key Features of WE2

The WE2 is an AI processor capable of 50 GOPs of performance while consuming only 1-10mW of power in a 1mm² die area. Key features include:

- Dual Arm Cortex-M55 processor
- Arm Ethos-U55 for AI acceleration
- No external DRAM required
- Integrated DC-DC converter for power efficiency
- Hardware security features like secure boot
- Support for TensorFlow Lite Micro and TVM
- Open-source toolchain.

Leveraging Arm

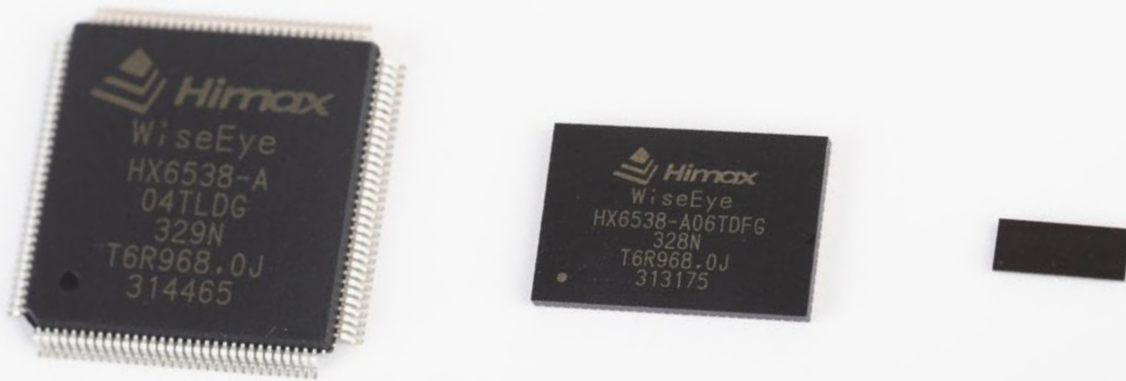
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- **Performance:** The Cortex-M55 enables high-speed vision processing, with the “big” core running at up to 400MHz for ML workloads. This delivers significantly faster inferencing versus using just a microcontroller. The chip uses Helium instructions for image processing before AI inference, as well as image cropping, resizing and color adjustment.
- **Efficiency:** The “LITTLE” Cortex-M55 core runs at 150MHz for always-on tasks at very low power.
- **Scalability:** The Cortex-M55 is compatible with Arm’s ML frameworks like CMSIS-NN, enabling flexible software development. For example, the same code can run on Cortex-M55 or other Arm cores.
- **Hardware integration:** Integrating the processor with Arm Ethos-U55 accelerator and vision IP enables tightly coupled processing between the CPU, hardware accelerators, and peripherals.
- **Ecosystem support:** Using the Cortex-M55 allows tapping into Arm’s broad ecosystem of tools, software, and support. This was a key factor in Himax’s decision.

Optimized for Vision Applications

The WE2 is optimized for running vision AI models at the edge. The chip can run at up to 400MHz to handle vision processing. Himax has demonstrated models for:

- **Face detection and landmarks:** It goes beyond basic face detection to also perform facial landmark detection, identifying key facial structures like eyes, nose, and mouth.



- **Human pose estimation:** The WE2 can estimate the pose of the human body by detecting key joints and limbs. It identifies body parts like arms, legs, torso, and head to determine the overall body position and movements. This has applications in fitness tracking, gesture control, and identifying actions.
- **Object detection:** Object detection Yolo v8n models can run on the WE2 to detect and classify multiple objects in a scene. It can identify common objects like people, cars and car plates, animals, household items, parcels left at doors, and more across over 80 categories.

Designed for Flexibility

With support for external flash, the WE2 allows large AI models to be stored off-chip. The chip can interface with image sensors via DVP. Himax adopted the Arm ecosystem for software compatibility.

Himax leverages open-source tooling — including Keil MDK, VS Code, TensorFlow MOT, Pytorch and TinyNeuralNetwork — to enable users to develop custom AI applications optimized for low power. Himax provides reference models to help bootstrap development.

Early Customer Adoption

The WE2 is already being adopted by customers. One use case is integrating the chip with laptop cameras for user presence detection during standby mode. This allows the system to wake on seeing the user.

The WE2's energy efficiency makes it suitable for battery-powered and mainstream edge products. Himax plans to add integrated image signal processing in future generations to further improve vision capabilities.

In summary, the Himax WE2 enables AI inferencing on resource-constrained edge devices. With its innovative architecture optimized for computer vision, the WE2 brings AI and machine learning to new types of endpoint and IoT products.

Useful Links

- Himax WiseEye2 AI Processor (WE2) [himax.com.tw/products/intelligent-sensing/always-on-smart-sensing/wiseeye2-ai-processor/]
- Arm Ethos-U55 [arm.com/products/silicon-ip-cpu/ethos/ethos-u55]
- Arm Cortex-M55 [arm.com/products/silicon-ip-cpu/cortex-m/cortex-m55]
- Arm Helium [arm.com/technologies/helium]
- CMSIS [arm.com/technologies/cmsis]