DEFINE, DESIGN, DEPLOY:
D3 Engineers create a high-megapixel connected camera for commercial imaging applications

A customer approached D3 Engineering with a concept for a high-end, professional, internet-connected camera. They chose D3 based on the strength of our reputation for product development using vision and video technology. We quickly defined, designed and deployed a complete camera solution integrating hardware and software for image capture, vision processing, focus control, and internet connectivity.

DEFINE: FROM IDEA TO SPECS TO EVT

The customer brought us a concept, a preferred image sensor, and a list of features they wanted in their new camera. From this, D3 Engineering developed product requirements and specifications.

We selected the architecture based on our expertise in vision processing, communications protocols, and motor control. Then we created a rapid Engineering Verification Test (EVT) prototype using off-the-shelf hardware to prove the concept.

D3 Engineering’s custom, high-MP internet-connected camera for a commercial imaging application

EVT IDENTIFIES ARCHITECTURE IMPROVEMENT

For the EVT, we combined off-the-shelf development boards for the Intel® (Altera) FPGA, Qualcomm® Snapdragon™ processor, and Infineon® XMC™ to quickly construct a functional prototype. We selected an off-the-shelf image sensor similar to the customer’s preferred sensor, which is not yet available.
The EVT prototype mitigates the technical risk of product development by allowing us to prove the concept and verify our planned architecture. It also allows the software team to get an early start on the firmware development.

In this case, we quickly identified an opportunity to optimize the image chain. We adjusted the partitioning of image processing algorithms between the Intel FPGA and the Snapdragon processor.

Taking advantage of these architecture improvements at the EVT stage gives the customer the best design without causing delays in the design phase, where changes become more difficult and expensive to manage.

**DESIGN: HARDWARE AND SOFTWARE FOR A COMPLETE VISION AND MOTION SYSTEM**

With the EVT verified, we moved on to design. We developed custom hardware, settling on a two-board solution. The **image sensor board** is mechanically aligned and mounted to the lens holder. The **processor board** integrates the FPGA, image processor and motor controller. As always, the D3 design team followed a structured process with emphasis on design for manufacturing (DFM).

In the meantime, the software development team implemented high-speed LVDS image capture and image pre-processing on the FPGA. We deployed our own MIPI CSI-2 output protocol, designed for Intel FPGAs, to deliver the image data at high speed to the Snapdragon processor.

The team configured the Snapdragon image processor for MIPI CSI-2 capture and implemented both H.265 and JPEG encoding. They set up and optimized the customer’s required connectivity options including WiFi, Near-Field Communication (NFC) and Bluetooth.

Finally, the motor control design team characterized the selected motors and implemented a real-time system for focus, shutter, and aperture control. The motor control system uses the Infineon XMC ARM Cortex-M microcontroller.

Our in-house prototype shop built a Design Verification Test (DVT) unit. The DVT successfully demonstrated the product features and confirmed its form, fit and function.

**DEPLOY: D3 SUPPORT GETS PRODUCTION RAMPED UP FAST**

The customer had already selected an offshore manufacturing partner for the new camera. D3 worked with this chosen manufacturer to ensure their successful ramp-up. We delivered a complete and fully documented design transfer package. We designed, built and delivered test fixtures, along with software for lens calibration, image sensor calibration, and hardware verification.

Then we followed up with constant communication via phone, email, chat and on-site visits to the plant. The project is on track for market introduction on schedule.

**LET’S GET IT DONE.**

If you have a product concept involving vision and video, motor control, and internet connectivity—or any combination of these —let's talk.