Image Sensor Module, Vision Module, Camera Module – What Are the Differences?

A number of modules for capturing images are available for image processing applications with embedded vision. They have different names, such as image sensor module, camera module or vision module. What are the differences between these modules? Our Product Insight answers this question.

Definition of the terms image sensor module, camera module and vision module

Image sensor module: An image sensor module (also referred to as simply “sensor module”) or image sensor board (abbreviated to “sensor board”) is just an image sensor on a printed circuit board (PCB). The advantage is that the customers do not have to produce the sensor boards themselves.

Camera module: Customers get more with a camera module. They get image pre-processing, a software package (or software development kit - SDK) for the operation and control of the module, APIs for the programming, all desired drivers, comprehensive documentation and sometimes even a support hotline.

Vision module: The term vision module is not defined as clearly as the previous terms. The user has to find out on a case-by-case basis what kind of scope and accessories the relevant vision module offers.

What do the different modules offer in detail?

Image pre-processing: Raw data from a sensor generally still needs some corrections to ensure that irregularities and minor flaws within the sensor are compensated for. This includes non-uniformity in the image, coloring or fixed-pattern noise. Image pre-processing handles this task.

The image pre-processing is performed on a so-called in-camera processor, typically an FPGA, or on the host side. It’s most efficient to use an image signal processor that is specialized for this task. To enable this, drivers are provided that work together with the sensor generically or after some adjustments.

Drivers & software packages: These are part of a camera module and required to directly operate the camera module. The drivers and software routines also enable access to the camera, e.g. the camera’s image capture (such as a readout of the image data) and the control of the camera (start/run/trigger/settings). A good software makes many features available, such as settings for the resolution, ROI (region of interest) and auto-setup functions.
Another plus of adding these to the camera module hardware lies in the stable and clear APIs that enable easy software development and simple integration and connection to other software.

This leads directly to documentation & support: the documentation provides a clear description of the features, commands, implemented functions and their exact scope as well as sample applications. Last but not least, good support is important for questions and problems that might arise during the integration of such a module.

All modules generally represent a mechanical solution. This includes the soldering of the image sensor, the option to screw in or fasten the module, and the connection through a plug or cable.

**Summary**

Camera modules offer many features that can be used for specific applications. Additionally, software, drivers and tools are available for fast connectivity to a system. Reading out image data and making it available for further processing is easy, and the camera can be operated with simple and precise controls.

All this ease-of-use support is missing in sensor modules. This means, that much more effort, adjustment and know-how are required to implement a good and stable solution. It also increases the development risk. Image sensor modules consist solely of hardware and the developer must integrate and install them by himself into the system to produce the data flow and control.

Terminology in this field is not always consistent: terms such as “vision module”, “imaging module” or just “module” do not always describe elements with the same features and parameters. Each case requires a careful review of what is offered and whether it will meet the user’s requirements.

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**About Basler**

Basler is an internationally leading manufacturer of high-quality digital cameras and accessories for applications in factory automation, medicine, traffic and a variety of other markets. The company’s product portfolio encompasses line scan and area scan cameras in compact housing dimensions, camera modules in board-level variants for embedded vision solutions, and 3D cameras. The catalog is rounded off by our user-friendly pylon SDK and a broad spectrum of accessories, including a number developed specially for Basler and optimally designed for our cameras. Basler has 30 years of experience in the area of computer vision. The company is home to approximately 500 employees at its headquarters in Ahrensburg, Germany, and its subsidiaries and sales offices in Europe, Asia and North America.