Allied Vision

WHITE PAPER

GenICam—yet another standard?

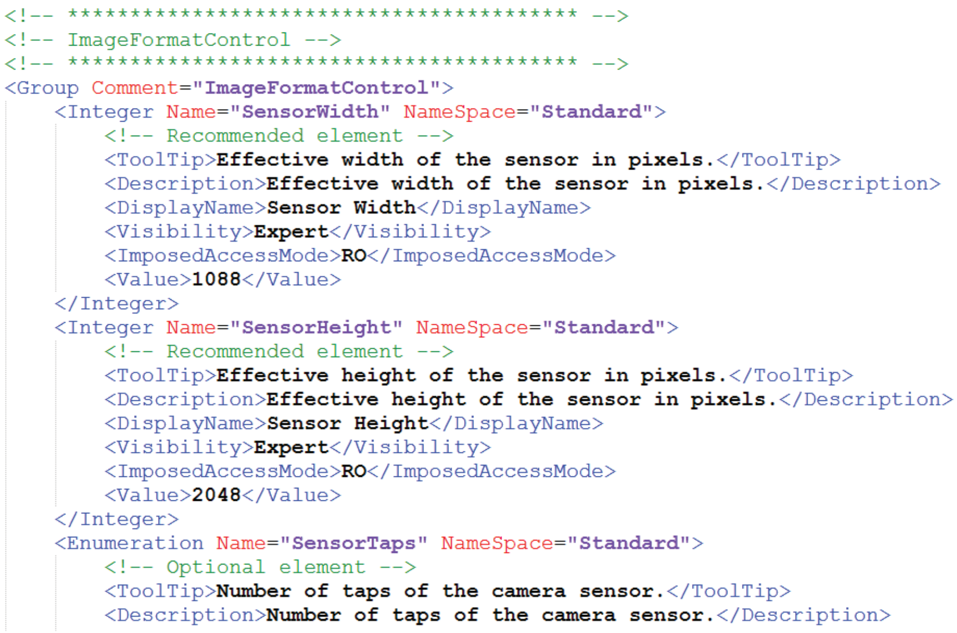
GenICam—**Gen**eric **I**nterface for **Cam**eras—is today's most popular standard for industrial vision applications. This white paper outlines how your embedded vision projects can benefit from GenICam and why GenICam is expected to break into the embedded vision world.

The motivation behind GenICam

Years ago, when industrial cameras evolved and began to offer more and more models, interfaces, and on-board features, machine vision developers became increasingly frustrated by the tedious camera control via register access and the need to reinvent the wheel for almost every project. Consequently, leading industrial vision camera and software manufacturers cooperated to develop a more efficient industry-wide approach. In 2006, the first GenICam standard was published with great success: Eventually, it was possible to develop vision applications much quicker and to reuse source code for other projects with different cameras and sensors, and even to use one API for different camera interfaces.

Self-describing cameras

Instead of the mostly unstandardized and tedious camera control via register access, GenICam relies on self-describing cameras and the GenAPI module: An XML file with standardized syntax, which is usually stored in the camera, can be read out and used for camera control by every GenICam-compliant software—independent of the camera's manufacturer, interface, and feature set. Moreover, properties like descriptions, tooltips, or units can can be forwarded to a GUI.

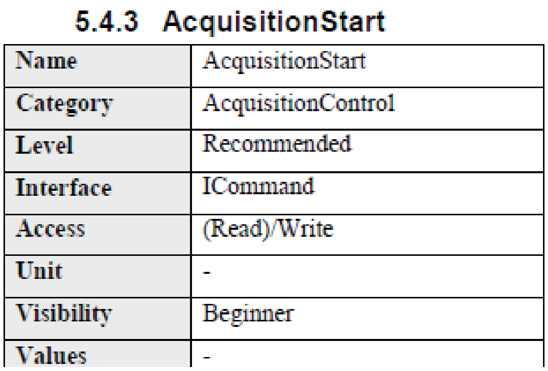


```
<!-- ***************************************** -->
<!-- ImageFormatControl -->
<!-- ***************************************** -->
<Group Comment="ImageFormatControl">
    <Integer Name="SensorWidth" NameSpace="Standard">
        <!-- Recommended element -->
        <ToolTip>Effective width of the sensor in pixels.</ToolTip>
        <Description>Effective width of the sensor in pixels.</Description>
        <DisplayName>Sensor Width</DisplayName>
        <Visibility>Expert</Visibility>
        <ImposedAccessMode>RO</ImposedAccessMode>
        <Value>1088</Value>
    </Integer>
    <Integer Name="SensorHeight" NameSpace="Standard">
        <!-- Recommended element -->
        <ToolTip>Effective height of the sensor in pixels.</ToolTip>
        <Description>Effective height of the sensor in pixels.</Description>
        <DisplayName>Sensor Height</DisplayName>
        <Visibility>Expert</Visibility>
        <ImposedAccessMode>RO</ImposedAccessMode>
        <Value>2048</Value>
    </Integer>
    <Enumeration Name="SensorTaps" NameSpace="Standard">
        <!-- Optional element -->
        <ToolTip>Number of taps of the camera sensor.</ToolTip>
        <Description>Number of taps of the camera sensor.</Description>
```

The camera XML file describes the features, their data formats (int, float, enum, command), boundaries (min, max, increment size), and dependencies. Features and their properties can be forwarded to a GUI.

Standardized features for reusing code

Within the GenICam standard, the SFNC (Standard Features Naming Convention) module defines both feature names and feature properties, so that code can easily be reused with other cameras—even if not just their feature set is different, but also if they come with a different interface or from a different manufacturer. For example, only the (mandatory) feature name AcquisitionStart (not AcqStart) is allowed. For vendor-specific features, the SFNC allows enough flexibility.



5.4.3 AcquisitionStart

Name	AcquisitionStart
Category	AcquisitionControl
Level	Recommended
Interface	ICommand
Access	(Read)/Write
Unit	-
Visibility	Beginner
Values	-

SFNC excerpt: standardized features

Supported camera interfaces

GigE Vision, USB3 Vision, CoaXPress, and the latest Camera Link standard imply GenICam-compliance. Moreover, GenICam-compliance can be achieved even for other interfaces: For example, some manufacturers offer GenICam control of their FireWire cameras. The first GenICam-compliant MIPI CSI-2 cameras will be released soon by Allied Vision.

GiGE VISION USB3 VISION CoaXPress CAMERA Link FireWire mipi

GenICam APIs

Camera manufacturers who comply with the GenICam standard usually offer a free-of-charge SDK with APIs for C and C++ as well as a viewer application for plug & play camera control. Of course you can integrate libraries such as OpenCV.

Communication with third-party software

While the GenAPI enables camera feature control by the user, the GenTL (Generic Transport Layer) handles the physical aspects (for example, it allows listing available cameras) and provides the transport of image data from the camera (the GenTL producer) to the host (the GenTL consumer). Any GenICam camera can be used with tools like MATLAB if they provide a GenTL interface to GenTL producers. You just have to install the camera's transport layer and driver.

GenICam and the future of embedded vision

As of now, most established industrial machine vision applications such as quality control, industrial inspection, or traffic control use GenICam and run on PCs. With the increasing performance of embedded systems, many of these applications will migrate to embedded systems during the next years. Of course, developers and customers who are used to the benefits of GenICam would not be willing to step backward to camera control via register access or to use APIs such as V4L2, which is not suitable for many industrial applications. Moreover, it is taken for granted that cameras can easily be exchanged to reach better performance or to save costs. With hundreds of thousands GenICam cameras sold each year, the migration of industrial vision applications to embedded systems will imply the migration of GenICam as well. Furthermore, GenICam cameras with on-board image pre-processing features are entering embedded vision.

More information about GenICam

You can find more information about GenICam on the EMVA website:
http://www.emva.org/standards-technology/genicam/

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