

Using Dragonfly IEEE-1394 Digital Camera and Image Acquisition Toolbox

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Abstract

Application of a digital camera using IEEE 1394 Fire Wire specification seems now to be a perspective way. Cheap IEEE 1394 plugged-in board substitutes expensive frame grabber board. But serial interface limits available bandwidth to 320 Mbps and consequently number of frames per second. But this system can solve many practical problems. Possibility to drive such camera from MATLAB using Image Acquisition Toolbox brings interesting data acquisition. Submitted paper concerns our first experience in application of Dragonfly IEEE 1394 Digital Camera and Image Acquisition Toolbox.

1 Short description of the system

In the used PC is installed Windows 2000 system.

The Dragonfly is an OEM-style IEEE 1394 board level camera providing control and flexibility for industrial machine vision tasks. Used camera has color CCD sensor with 1024x768 resolution and 15 frames per second. Partial Image Format (sub-sampled) allows the user to transmit a sub-sampled 640x240 image at up to 50 fps. The 6-pin 1394 standard cable provides the camera with both power and a connection to computer having IEEE 1394 plug-in board. The camera is supported by the original PGR Fly Capture software, but we describe its application with Image Acquisition Toolbox.

The Image Acquisition Toolbox is a collection of functions that extend the capability of the MATLAB® numeric computing environment. The toolbox supports a wide range of image acquisition operations from professional grade frame grabbers to USB-based Webcams. The toolbox lets you connect to and configure your hardware, preview your video, and stream images directly into MATLAB for analysis and visualization. Many of the toolbox functions are MATLAB M-files.

2 Installation

Installation of the Dragonfly camera to MATLAB 7 having Image Acquisition Toolbox was quite simple. Camera worked immediately after initialization using toolbox functions.

Image Acquisition Toolbox released with Matlab 7 in May 2004 has installed adaptors: {'*dcam*' '*winvideo*'}. Adaptor '*dcam*' should be used by digital cameras that comply with the DCAM specification. Camera using '*dcam*' worked in our case only in monochrom mode. We got the information that the color mode should be realised in the next version.

Former version (with Matlab 6.5.1) has only adaptor '*winvideo*' but it works in monochrom and also in color mode. Every mode of the camera work depends on used driver.

In the case the Image Acquisition Toolbox (older version) has only 'winvideo' adaptor there is necessary to follow next recommendation. To work with digital cameras that comply with the DCAM specification, one must download the DCAM driver created by the Carnegie Mellon University (CMU). This is the only DCAM driver supported by the toolbox. To download the DCAM driver, one must go to the Web site

www-2.cs.cmu.edu/~iwan/1394

and click on the download link.

After extracting the zip archive, one must choose to use the DCAM driver with the device instead of the driver provided by the vendor. On Windows 2000 systems, follow this procedure. (Some of the steps might differ slightly on other versions of Windows.) Make sure that your camera is plugged in.

- 1) Click the Start button, go to the Settings menu and select Control Panel.
- 2) On the Control Panel menu, select System. In the System Properties dialog box, click the Hardware tab.
- 3) On the Hardware panel, click the Device Manager the button. In the Device Manager the dialog box, expand the Imaging devices section.
- 4) Right click on the device you intend to use and select Properties. In the Properties dialog box, click the Driver tab.
- 5) Click the Update Drivers button and use the Update Device Drivers Wizard to select the CMU DCAM driver. You must specify the directory in which you stored the driver files you downloaded from CMU. Do not use the search option. Use the "Display a list of..." option instead. Select the file named *1394camera.inf*. Ignore the warnings about the driver not being digitally signed.
- 6) Verify in the Driver tab that the provider is Carnegie Mellon University. Also verify that your camera is now listed in the Device Manager as "CMU 1394 Digital Camera Device".
- 7) Restart your computer to ensure that the camera uses the new driver.

3 Working with properties of the system

Image Acquisition Toolbox gives the user the set of simple functions allowing define and read general settings and device specific properties. Help function is well prepared to inform about all toolbox functions as usually. Only special applications like sub-sampled 640x240 image or external triggering needs special care. Also application of two cameras on one bus is our next orientation.

4 Applications

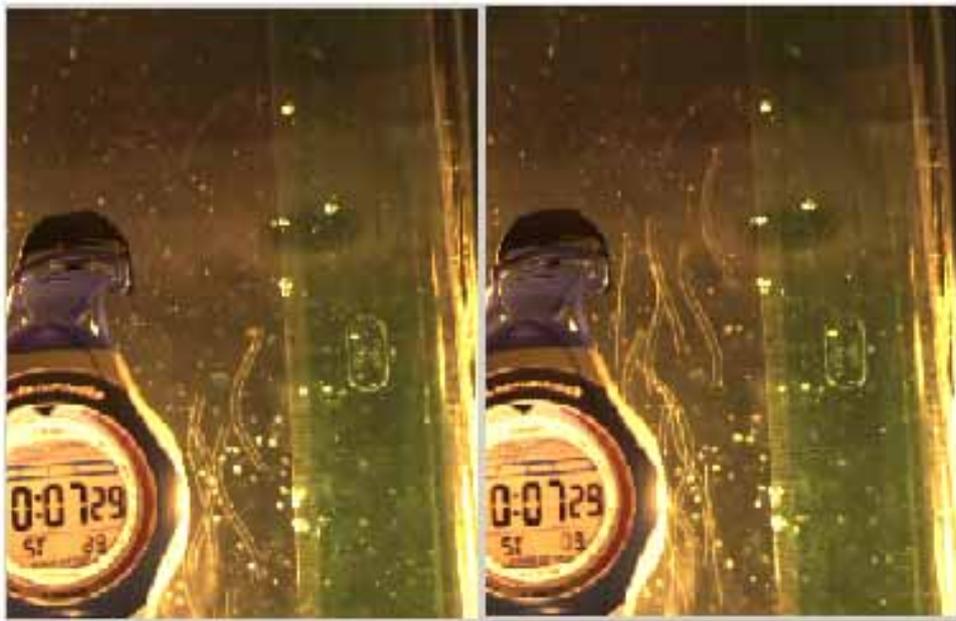
The camera was used to study aerated system to check its fractal or multi-fractal structure [2] – fig.1. The other application was study of laminar and turbulent flow patterns [3] – fig.2. The fig.3 shows extempore measurement of the velocity of the air bubbles raising in the water used as example in the school laboratory for education of the students. All applications compare several images which are processed by functions from the Image Processing Toolbox.



Obr.1



Obr.2



Obr.3

4 References

- [1] PGR Dragonfly Technical Reference Manual, Version 2.1.2.13, 2003
- [2] Kukul J., Kubíček M., Majerová D.: Multifractal Analysis of Aerated System, 15th International Conference on Process Control, 2004, Czech Republic
- [3] Kubíček M., Kukul J., Majerová D.: Fractal analysis of laminar and turbulent flow patterns, 14th International Conference on Process Control, 2003, Slovak Republic