Tcl Extension for
IEEE1394(Firewire) Video Cameras
** and**
** Raw-to-Color Image Conversion**

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Objectives

ν Controlling IIDC compliant IEEE1394(Firewire) video cameras in a variety of environments

- ♦ Variety of objectives: surveillance, robotics, video-conference, etc.
- ♦ Variety of feature sets in cameras
- ♦ Multiple cameras

ν Convert raw digital data to color images

- ♦ No perfect conversion algorithm
- ♦ Dependence of performance on various conditions

Role of Tcl/Tk

ν   Fast and easy building of customized design for both the camera control and raw-to-color conversion
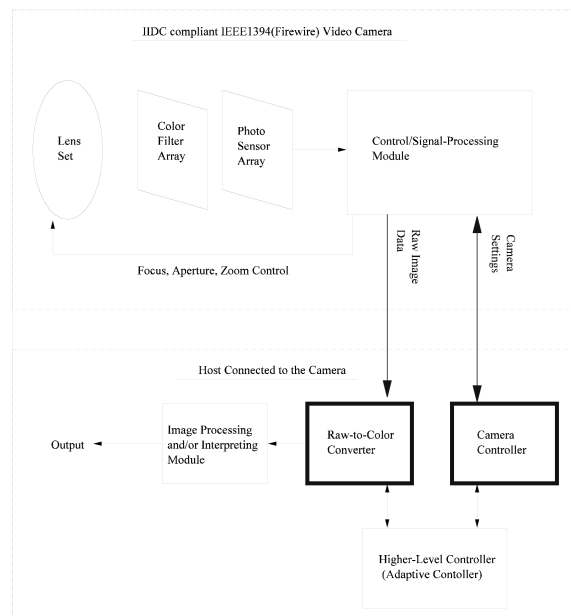
IEEE1394 and IIDC

ν   IEEE1394 (Firewire by Apple, i.Link by Sony)
- ♦   Strengths over USB
  - ν   Guaranteed bandwidth
  - ν   Full peer-to-peer communication
  - ν   Fast (IEEE1394b 800Mbps, 3.2Gbps)

ν   IIDC (DCAM)
- ♦   No data compression in contrast to consumer camcorders

Related Work of Controlling IIDC IEEE1394 video cameras

ν Coriander for Linux
  ♦ Open source software by the author of libdc1394

ν Commercial products

ν Foundation for all the open-source applications
  ♦ libraw1394
  ♦ libdc1394

IIDC compliant IEEE1394(Firewire) Video Camera

Lens
Set

Color
Filter
Array

Photo
Sensor
Array

Control/Signal-Processing
Module

Focus, Aperture, Zoom Control

Raw Image
Data

Camera
Settings

Host Connected to the Camera

Output

Image Processing
and/or Interpreting
Module

Raw-to-Color
Converter

Camera
Controller

Higher-Level Controller
(Adaptive Contoller)

Our Tcl Extension for Camera Control

ν   Initialization commands
     ::dc1394::initialize
     ::dc1394::listcameras
     ::dc1394::caminfo

ν   Control commands
     ::dc1394::save
     ::dc1394::startprocessing
     ::dc1394::haltprocessing
     ::dc1394::feature
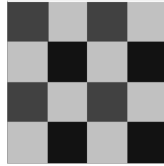   ::dc1394::callback

Example Code

```
namespace eval ::dc1394 {
    set format 0
    set mode 320x240_YUV422
    set framerate 30
    set camera_list [listcameras]
    :# Assume at least one camera exists

    initialize $camera $format $mode $framerate
}
```

Raw-to-Color converter

ν   Color filter before photo sensor array

ν   RGB Bayer filter

ν   Need for raw-to-color converter
ν   Guessing the other primary colors at each sensor element

Related Work of Raw-to-Color Conversion

ν   DCRaw
    ♦ Foundation of many other open source software

ν   UFRaw
    ♦ GUI extension of DCRaw

ν   Plenty of Commercial Products

Tcl Implementation

ν   Provides widely used algorithms
  ♦ Bilinear interpolation
  ♦ Cubic convolution interpolation
  ♦ Smooth hue transition interpolation
  ♦ Nearest neighbor replication

ν   Provides component procedures for building new custom algorithms by the user
  ♦ Gradient computation procedures
  ♦ Gaussian convolution
  ♦ Laplacian of Gaussian convolution
  ♦ etc.

Contribution to the TCL Community

ν   Tcl-based IIDC IEEE1394 camera controllers

  ♦ Fast and easy building of customized application

ν   Tcl-based raw-to-color converter

  ♦ Widely used algorithms plus great customizability with variety of component algorithms available as Tcl commands