Wide Dynamic Range Image Processing System

using Super CCD Honeycom SR


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Required Performance of Digital Still Camera

High

ISO

Low

Shutter speed

fast

slow
Common Image Quality Problems

Blurring = Camera/Subject movement
Noise

Color Balance
Brightness
Color Repro

Tonal reproduction
Dynamic Range
- Flat Shadows
- Washout Whites

ISO
High
low

Shutter speed
slow
fast
High Speed Camera System/Anti Shake System/Noise Reduction

Blurring = Camera/Subject movement
Noise

High ISO

Gradation design
Tonal Reproduction
- Flat Shadows
- Washout Whites

Washout Whites

CCD/CMOS

Color Repro

Image Processing

Slow

Shutter speed

Fast

Color Balance

AWB System

Brightness

AE System
Image Quality

• Important factors
  1. Resolution  □  High pixel density CCD
  2. Sensitivity, Noise(S/N)
     □  High sensitivity CCD, Noise Reduction
  3. Dynamic Range  □  CCD performance
  4. Color reproduction  □  Image Processing
**Dynamic Range (DR) of Conventional CCD**

- Lose details of whites
- Narrow Exposure Latitude
White Subjects

- Face: Correct exposure
- Dress: No texture

- Face: Under exp. (Dark)
- Dress: Correct exposure
High Subject Contrast (Back-lit)

Exposure adjusted to face
High Contrast Lighting

- Wash-out
- Lost texture

[Image showing a person with highlights indicating issues with lighting]
How to improve Dynamic Range of CCD

- Characteristics of CCD/Photo Diode (PD)
  - Conventional CCD
  - Larger size PD
  - Large pixel number
  - Lower Sensitivity setting
  - Low Noise
Approach to Wider D-Range

Required Performance = Wide Dynamic Range

- Low light condition ▶ High Sensitivity to obtain shadow details
- Bright condition ▶ Low Sensitivity to obtain highlight details

Possible Solutions

- Double Image Sensor Chip System ▶ Bigger Size Camera
- Compose 2 different exposure images ▶ Still Photography Use only
- Hi-sensitive PD and low-sensitive PD on the same CCD chip ▶ ½ Resolution but…
Super CCD Honeycom IV SR

(introduced in 2003)

1st generation Wide D-Range CCD
Designed for Compact Digital Cameras
Specially designed for Digital SLR, S3Pro

- More optical flexibilities
  (geometrical PD arrangement)
**D-Range of Hi-sensitivity PD and low-sensitivity PD**

<table>
<thead>
<tr>
<th></th>
<th>高感度PD</th>
<th>低感度PD</th>
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<tbody>
<tr>
<td>sensitivity</td>
<td>1</td>
<td>1/16</td>
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<tr>
<td>Saturated Out-put</td>
<td>1</td>
<td>1/4</td>
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Low-sensitivity PD has wider exposure D-Range.
Blending image information

( Case of 1st generation SR sensor)

Combining information from both Sensor elements, CCD SR is able to deliver both higher sensitivity and expanded D-Range.
Dynamic Range and Digital Image

Digit Value

DR100%

DR400%

2EV
Merit of Wide DR 1
Merit of wide DR 2
**Merit of Wide DR**

- **Exposure Level**
  - +1 EV
  - 0 EV
  - -1 EV

**Super CCD**

**Super CCD Type SR**
Merit of Wide DR 4

Exposure Level

+1 EV

0 EV

-1 EV

Super CCD

Super CCD Type SR
D range comparison

2

3
D range comparison
D range variation

230% (W1)

100%

400% (W2)
**D range variation**

230% (W1)

100%

400% (W2)
Super CCD Honeycom SR

Conventional CCD w/Low contrast

Wide D-range vs Low Contrast setting
Thank you very much