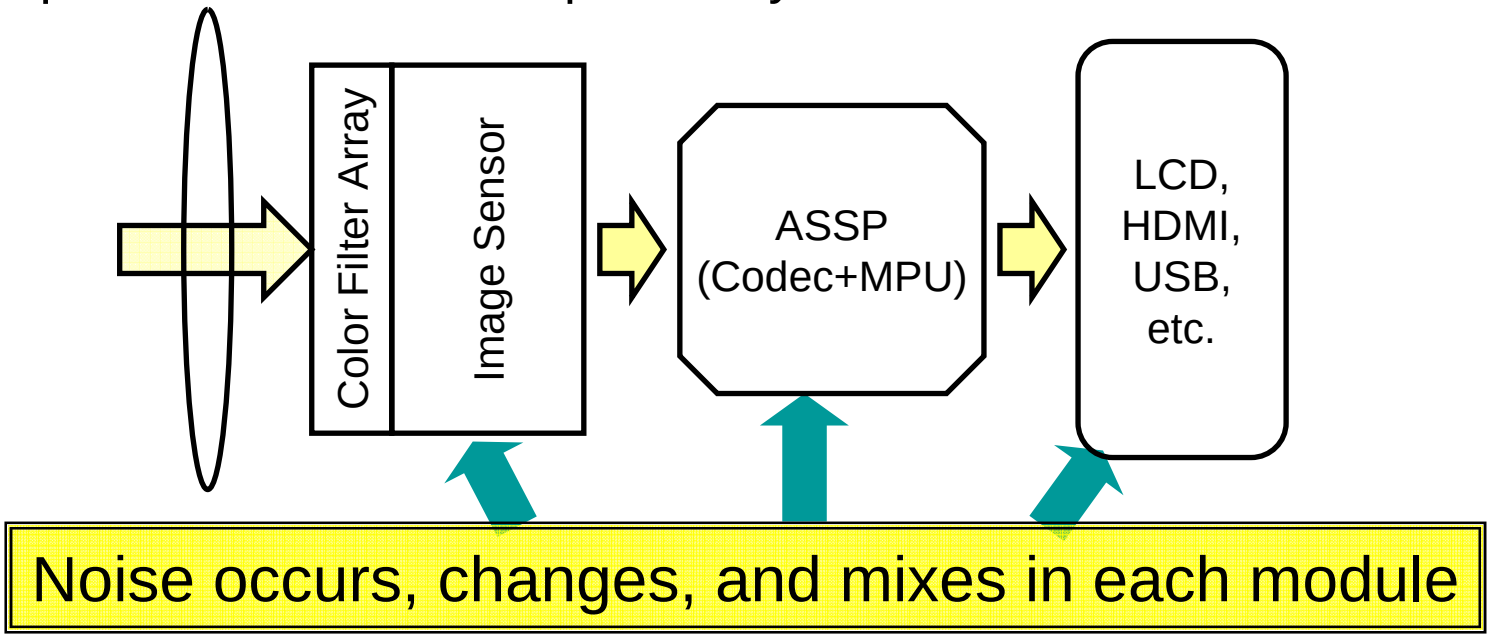
Background

- High resolution consumer camcorders are widely used
- Various kinds of noise are include in video taken by camcorders
  - It is difficult to separate each noise from resulted video, since the current camcorder system is complex, achieving high performance with compact body



Objectives

- In development of consumer camcorders, noise is evaluated subjectively by video quality specialists using prototypes
  - This scheme requires much man-hours and limits the turn around time
- An efficient noise evaluation scheme is high required
  - Noise evaluation scheme for consumer camcorders
  - Real-time noise evaluation systems

- Noise characteristics for each camcorder mode is investigated
- Detailed evaluation of noise in camcorders is carried out, which includes evaluation of temporal change of noise

Overview of noise evaluation

- Environment of noise evaluation
  - Video sequences taken in completely dark room are used
  - Six camcorders are used in this experiment
    - Totally 34 pattern video sequences are used, since there several recording option for each
- Noise evaluation method
  - Difference of noise among models and settings are evaluated
    - Fixed pattern noise is used for this evaluation
  - Metrics of noise evaluation for still cameras can be used
    - When we evaluate noise in video sequence, we have to pay attention to not only spatial noise component but also temporal component

Detail of noise evaluation

- Evaluation method
  - Utilizing the following data
    - Average frame

$$I'(x,y)=\sum_{t=0}^{T} I(x,y,t)$$

      - Random noise is suppressed, and pattern noise is emphasized
    - RMS granularity
      - See the noise strength and temporal change of noise
    - One frame data

$$I_t(x,y)$$

    - Line data

($f(x)$,$g(y)$,$h(t)$; given by the right equations)

$$f(x)=\sum_{y=0}^{H} I'(x,y)$$

$$g(y)=\sum_{x=0}^{W} I'(x,y)$$

$$h(t)=E[I_t(x,y)]$$

    - Dark frame data used in flat fielding

$$I''(x,y)=\mathrm{Med}\,(I_0(x,y), I_1(x,y),..., I_T(x,y))$$